

Errata

Title & Document Type: 5325A/B Universal Counter Operating and Service Manual

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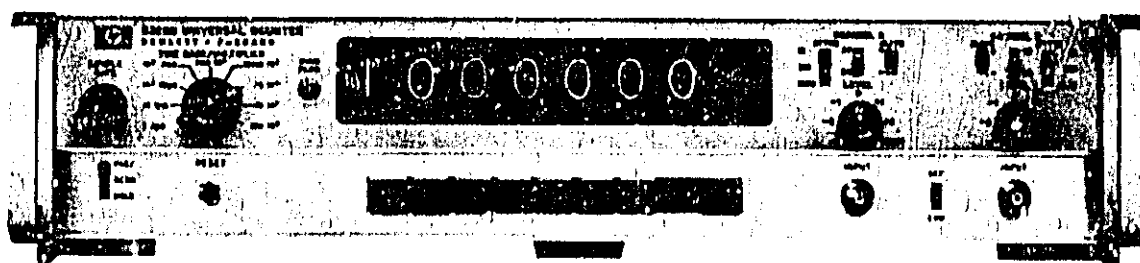
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Agilent Technologies

OPERATING AND SERVICE MANUAL

UNIVERSAL COUNTER 5325B



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The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facility.

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UNIVERSAL COUNTER

5325B and 5325A

SERIAL PREFIX: 1216A

This manual applies directly to HP Model 5325B Electronic Counters having serial prefix number 1216A.

SERIAL PREFIXED NOT LISTED

For newer instruments with serial prefix above 1216A, a "Manual Changes" sheet is included with this manual. For older instruments with serial prefix below 1216A, changes required to backdate this manual can be found in Section VII. Model 5325A is also described in Section VII.

OPTIONS

For instruments having Option 901, refer to Section VII.

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90013

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MANUAL CONTENT

This manual is supplied to help you make best use of your instrument. The manual covers eight sections of information as follows:

SECTION I is an introduction to the instrument. Electrical specifications are given, plus information on accessories and applications.

SECTION II covers inspection, power, mounting, packing, shipping and connection.

SECTION III outlines operating procedures.

SECTION IV discusses logic fundamentals and operation of assemblies.

SECTION V contains disassembly and repair procedures and an in-cabinet performance check.

SECTION VI lists replaceable parts.

SECTION VII gives information on options and manual changes.

SECTION VIII contains circuit diagrams, component locators and waveforms. Also included are adjustment procedures and troubleshooting information.

HOW TO ORDER

To order an operating and service manual, contact the nearest Hewlett-Packard Sales and Service office. Give complete model, name and eight digit serial number. The serial number plate is on the rear panel (see Paragraph 1-10 for serial number system). Comments on this manual are welcome at any Sales and Service office.

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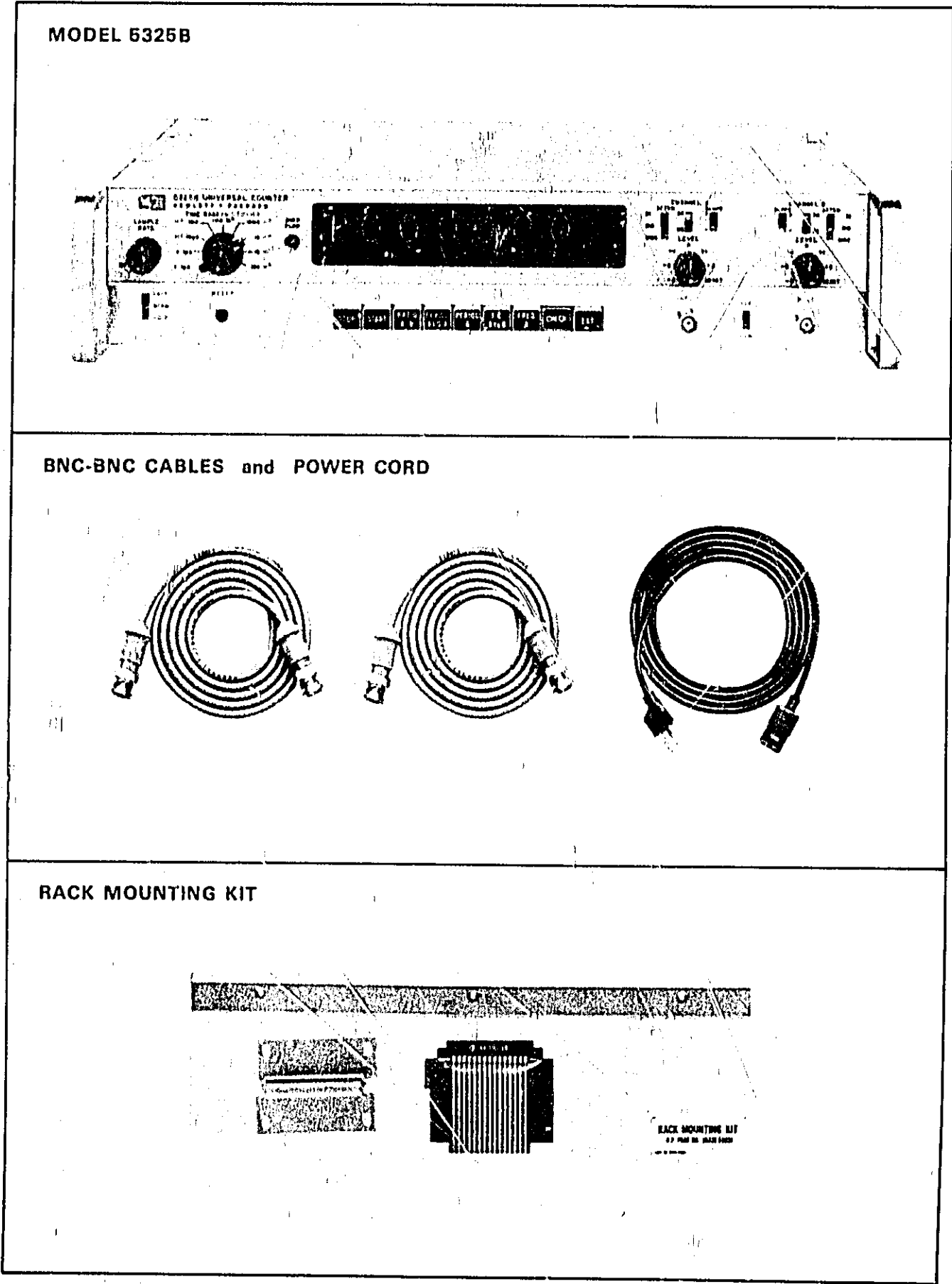
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Figure 1-1. Model 5325B and Accessories



SECTION I

GENERAL INFORMATION

1-1. DESCRIPTION

1-2. The Hewlett-Packard Model 5325B Universal Counter measures frequencies from 0 to 20 MHz, period average up to 10^8 , the ratio of two frequencies, and the time interval between any two events over the range of .1 μ s to 10^8 seconds. The Counter features solid state design using integrated circuits.

1-3. Other features are:

- a. True buffer storage. This provides digital recorder information during the gate time.
- b. Blanking of insignificant digits in the display.
- c. Remote programming.
- d. Decade scaling up to 10^8 .
- e. Display overflow indicator.
- f. 100 μ s maximum sample rate.
- g. Oscilloscope marker output.
- h. Four-line BCD output (+8421) for use with digital recorder.

1-4. SPECIFICATIONS

1-5. Table 1-3 gives all electronic and mechanical specifications for the Counter.

1-6. APPLICATIONS

1-7. The 5325B will measure speed, flow rate, and other phenomena when used with appropriate transducers. It can simplify design, test, and calibration of

of filters, oscillators, scalars and other devices that require critical frequency or time interval measurement in their manufacture or maintenance.

1-8. OPTIONS

1-9. The Counter is available with the following option: Option 01, remote programmable input attenuator and AC-DC switch for Channels A and B.

1-10. INSTRUMENT IDENTIFICATION

1-11. Hewlett-Packard uses a two-section serial number mounted on the rear panel. Earlier instruments use an eight-digit serial number (000-00000). The first three digits are a serial prefix number; the last five digits refer to the specific instrument. Later instruments use a nine-digit serial number (0000A00000). The first four digits are the serial prefix and the last five digits refer to the specific instrument.

1-12. All instruments with same serial prefix are the same. The group of instruments to which this manual applies directly is identified on the title page. For older instruments (lower serial prefix) make manual changes listed in Section VII. For newer instruments, having serial prefix higher than those listed on the title page, a "Manual Changes" sheet is included, describing the required manual changes. The manual for an instrument having special electrical modification will include an insert sheet describing that modification. If a change sheet or special information sheet is missing, information can be supplied on request by any Hewlett-Packard Sales and Service office listed at the back of this manual.

1-13. EQUIPMENT SUPPLIED

1-14. Equipment supplied is listed in Table 1-1.

1-15. ACCESSORIES AVAILABLE

1-16. Accessories available are listed in Table 1-2.

Table 1-1. Equipment Supplied

Description	HP Part No.
Detachable power cord 7-1/2 feet (231 cm) long; NEMA plug	8120-1378
Two cables: 4 feet (122 cm) long, male BNC connectors	10503A
Rack mounting kit	05325-60031

Table 1-2. Accessories Available

Description	HP Part No.
Digital Recorder	5050B
Recorder interconnecting cable	10513A

Table 1-3. Specifications

INPUT CHANNELS A AND B	Accuracy: ± 1 count + time base accuracy + trigger error*.
Range: dc 0-20 MHz ac 10 Hz-20 MHz	Readout: μ s, ms, seconds, or 10's of seconds with positioned decimal.
Sensitivity (min.): 0.1 V rms sine wave. 0.3 V p-p pulse; 26 ns minimum pulse width, Ch A; 60 ns min., Ch B. Sensitivity can be decreased by 10 or 100 times, using the ATTENUATOR ("Range") switch.	PERIOD
Impedance: 1 M Ω shunted by 35 pF.	Range: 0 to 10 MHz.
Maximum Input: 120 V rms (<1 kHz) X1 range 250 V rms X10 range 500 V rms X100 range	Input: Channel A on front panel
Overload Level: 1.5 V rms x ATTENUATOR settings.	Frequency Counted: 10 MHz to 0.1 Hz selectable in decade steps.
Trigger Level: PRESET to center triggering about 0 V or adjustable:	Accuracy: ± 1 count + time base accuracy + trigger error**.
+ 1 V X1 range + 10 V X10 range + 100 V X100 range	Readout: μ s, ms, seconds, or 10's of seconds with positioned decimal.
Trigger threshold band <1.0 mV, referred to input at maximum frequency	PERIOD AVERAGE
Slope: Independent selection of positive or negative slope.	Range: 0 to 10 MHz.
Channel Inputs: Common or separate lines.	Periods Averaged: 1 to 10 ⁸ selectable in decade steps.
Marker Outputs: Rear panel BNC. -5 V pulse into 5 K Ω resistance, 0.7 μ s width (Marker A and B) at start and stop of gate time.	Input: Channel A on front panel.
START (TOTALIZING AND SCALING)	Frequency Counted: 10 MHz.
Frequency Range: 0 to 10 MHz.	Accuracy: ± 1 count + time base accuracy + trigger error**.
Function Setting: START pushbutton.	Readout: ns, μ s with positioned decimal.
Factor: 1 to 10 ⁸ selectable in decade steps.	RATIO
Input: Channel A on front panel.	Displays: Fa/Fb x Multiplier (M). M = 1 through 10 ⁸ , selectable in decade steps.
Output: Rear panel TIME BASE BNC.	Range: Channel A 0 to 20 MHz. Channel B 0 to 10.0 MHz.
Display: Channel A input divided by scaling factor.	Accuracy: ± 1 count of Fa + trigger error** of Fb.
FREQUENCY:	Readout: Dimensionless; positioned decimal point for number of periods averaged.
Range: 0 to 20 MHz.	TIME BASE
Input: Channel A.	Crystal Frequency: 10 MHz.
Gate Time: 0.1 μ s to 10 seconds in decade steps.	Stability:
Accuracy: ± 1 count + time base accuracy.	Aging Rate: Less than 3 parts in 10 ⁷ /mo.
Readout MHz or kHz with positioned decimal point.	*For any waveshape, trigger error is less than $\frac{0.0025}{\text{Signal Slope (volts}/\mu\text{s)}} \text{ microseconds.}$
TIME INTERVAL MEASUREMENT	**Trigger error is less than $\pm 0.3\%$ of one period + periods averaged for signals with 40 dB or better signal-to-noise ratio and 100 mV rms amplitude.
Range: 0.1 μ s to 10 ⁸ seconds.	
Input: Channels A and B; can be common or separate.	
Time Base Frequency Counted: 10 MHz to 0.1 Hz selectable in decade steps.	

Table 1-3. Specifications (Continued)

Temperature: ± 1 parts in 10^6 , 0° to 50°C .
 Line Voltage: ± 1 part in 10^7 for $\pm 10\%$ line voltage variation.
 Oscillator Output: 10 MHz, 1.0 V p-p, 50% (approx.) source impedance at rear panel BNC.

External Input:

1 MHz	1.0 V rms
2.5 MHz	1.0 V rms
5 MHz	1.0 V rms
10 MHz	1.0 V rms

Time Base Output: Negative pulses, +4 V to 0 V (open circuit), 100 ns wide. Available at rear panel BNC.

Gate Output: 0 V while gate open, +4 V while gate closed. Available at rear panel BNC.

GENERAL

Display: 7 digits, long-life neon digital display tubes.

Blanking: Suppresses display of unwanted zeros left of the most significant digit.

Display Storage: Holds reading between samples. Rear panel switch overrides storage.

Sample Rate: FAST position: Continuously variable from less than 100 μs to approximately 20 ms. NORM position: Continuously variable from less than 20 ms to approximately 5 seconds. HOLD position: Display can be held indefinitely.

Reset: Manual.

Overflow: Front panel neon indicates when the display range has been exceeded.

Remote Programming: All front panel controls are single line programmable except:

SE P-COM (separate-common) Switch

ATTN (input attenuators)

AC-DC Input Signal Coupling

Measurement units and decimal points are each single line programmable.

Connector mates with Amphenol 57-30500 (Hp 1251-CJ86).

Control Signal. Single line control each FUNCTION. Operated by DTL or TTL circuits or contact closure to ground.

Digital Output (for numerals only)

Code: 4-line 1-2-4-8 BCD, "1" state positive.
 "0" state: +0.25 V at -1 mA; +0.4 V at 5 mA.
 "1" state: +5 V open circuit, 2.5 k Ω source impedance, nominal.

Print Command: +5 V to 0 V, de coupled; occurs at end of gate time.

Storage: Buffer storage is provided so BCD output is constant while next measurement is being made.

Inhibit Input: Inhibits transfer of data to buffer storage when instrument's cycle time is less than time required for external equipment to interrogate BCD outputs. Positive inhibit +5 V.

Chassis Connector: Special HP manufactured connector assembly. (See Accessories Available below.)

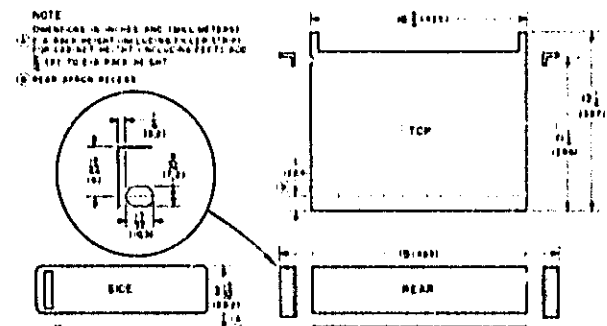
Connectors: All are BNC's except for Remote Programming (Cinch or Amphenol 57-40500-375) and Digital Recorder connectors.

Operating Temperature: 0° to 50°C .

Power Requirements: 115 or 230 volts $\pm 10\%$, 50 to 400 Hz, 35 watts maximum. Fast circuit breaker action with internal power reset switch protects supply. Also resets when main power is turn off.

Weight: Net, 10 lb. (4,6 kg). Shipping 15 lb. (6,8 kg).

Option 01: Remotely programmable attenuator switch and ac/dc switch.



SECTION II INSTALLATION

2-1. UNPACKING AND INSPECTION

2-2. If shipping carton is damaged, ask that carrier's agent be present when instrument is unpacked. Inspect instrument for damage (scratches, dents, broken knobs, etc.). If instrument is damaged or fails to meet specifications, (Performance Check, Table 5-3), notify carrier and nearest Hewlett-Packard Sales and Service office immediately (offices are listed at the back of this manual). Retain shipping carton and padding material for carrier's inspection. The Sales and Service office will arrange for repair or replacement of instrument without waiting for claim against carrier to be settled.

2-3. STORAGE AND SHIPMENT

2-4. To protect electronic equipment during storage and shipment always use best packing methods available. A Hewlett-Packard Sales and Service office can provide packing material such as that used for original factory packaging. Contract packaging companies in many cities can provide dependable custom packaging on short notice. Following are recommended packing methods.

2-5. Cover painted surfaces of instrument with protective wrapping paper. Pack instrument securely in strong corrugated container (350 lb./sq. in. bursting test) with 2-inch pads placed along all surfaces of instrument. Insert fillers between pads and container to ensure a firm fit.

2-6. ENVIRONMENT. Conditions during storage and shipment should be limited as follows:

- Maximum temperature: +167°F (+75°C).
- Minimum temperature: -40°F (-40°C).

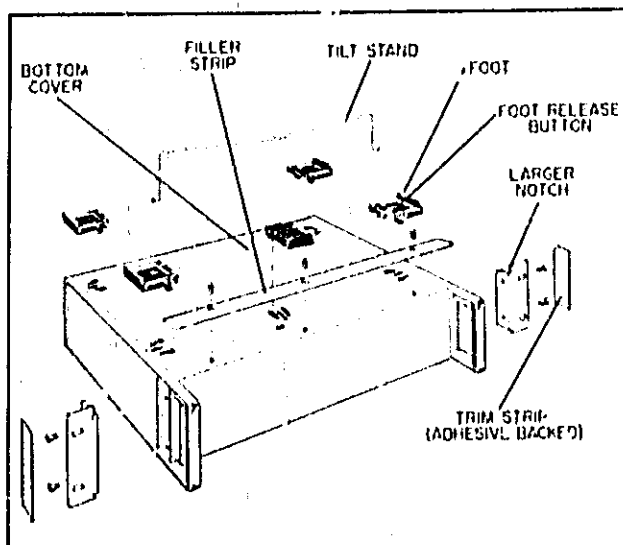
2-7. RACK INSTALLATION

2-8. The Counter is ready for bench operation when shipped. A rack mounting kit is included with instrument. To convert instrument for rack installation refer to Figure 2-1 and proceed as follows:

- Remove tilt stand.
- Remove feet (press foot release button, slide foot toward center on instrument, and lift off).

2-9

Figure 2-1. Conversion for Rack Mounting



c. Remove adhesive-backed trim strips at front end of sides.

d. Attach filler strip along bottom edge of front panel.

e. Attach flanges to front end sides (larger corner notch toward bottom of instrument). The instrument is ready for rack mounting.

2-9. POWER CONNECTION

2-10. The instrument may be operated from 115 or 230 Vac (50 to 400 Hz) power lines. A slide switch on rear panel selects 115 or 230 volt operation. Insert a narrow blade screwdriver in switch slot and slide to expose either "115" or "230" markings to select 115 or 230 volt operation.

2-11. LINE FUSE. The line fuse is 0.50 ampere for 115 volt operation and 0.25 ampere for 230 volt operation.

2-12. POWER CORD. The instrument is supplied with a detachable power cord. Install as follows:

- Connect flat plug to ac line connector on rear panel.
- Connect plug on opposite end to 3-wire ac outlet.

Note

Exposed areas of the instrument are grounded through power cord. When only a 2-wire outlet is available, use HP adapter 1251-0048 and connect short wire, from side of adapter, to ground.

OPERATION

SECTION III
OPERATION

3-1. INTRODUCTION

3-2. This section includes Counter operating information. Paragraph 3-3 briefly describes the function of controls and connectors on front and rear panels. Table 3-1 gives digital recorder connections. Figures 3-2 through 3-10 are typical operating procedures for various measurement functions.

Table 3-1. Digital Recorder Connections

Function		ABJ2 Pin No.
Display	BCD Weight	
(Right End) 10^0 Units	8	18
	4	16
	2	16
	1	17
10^1 Tens	8	5
	4	8
	2	7
	1	6
10^2 Hundreds	8	E
	4	J
	2	H
	1	F
10^3 Thousands	8	P
	4	M
	2	N
	1	R
10^4 Ten Thousands	8	K
	4	10
	2	9
	1	L
10^5 Hundred Thousands	8	12
	4	14
	2	13
	1	11
10^6 Millions	8	T
	4	U
	2	V
	1	S
Print Command: +5 V to 0 V, de-coupled; occurs at end of gate time.		D
Inhibit Signal: +5 V		B
Reference: +5 V, indicates "1" level for BCD output,		3
Ground		1

3-3. CONTROLS AND CONNECTORS

3-4. The function of controls and connectors are as follows:

FRONT PANEL

- SAMPLE RATE, turns Counter on and determines length of time following gate closure during which the gate will not open.
- FAST/NORM/HOLD, selects range of SAMPLE RATE control and holds display.
- TIME BASE/MULTIPLIER, selects time base or multiplier.
- RESET, resets display to all zeros.
- Nine-push buttons, select measurement functions.
- ATTEN, attenuates input signal by factors of 1, 10, or 100.
- AC-DC, selects ac or dc coupling to input amplifiers.
- SLOPE, +- selects triggering polarity of input signal.
- LEVEL, adjusts trigger level (normally set to PRESET for sine wave input).
- Channel A or B INPUT, connect signal to be counted here.
- COM-SEP, connects Channel A and B INPUT's in parallel, when set to COM.

REAR PANEL

- MARKER A and B, gives signals for oscilloscope intensity modulation.
- INT-EXT, selects either internal or external frequency standard.
- OSC, external standard is connected here, or internal standard is available.
- TIME BASE, gives time base output as set by TIME BASE/MULTIPLIER switch.
- GATE, gate output.
- DIGITAL RECORDER, gives BCD output for digital recorder.
- REMOTE PROGRAM, used to control Counter from a remote location.
- STORAGE, on-off, holds display (on) while a new count is being made.
- Line Voltage switch, selects 115 or 230 volt operation.

3. INTERPRETING DISPLAY

3-6. The Counter display is read directly with measurement units displayed and decimal point automatically positioned. In START-STOP mode, decimal points and measurement units are not displayed. The asterisk for the functions below indicate the following:

FUNCTION	*(ASTERISK) MEANS
PERIOD A / T, I, A to B }	To obtain readout in seconds, multiply display by 10.
FREQ A and CHECK }	The second most significant digit is not displayed.
RATIO A/B	Multiply display by 1/10.

3-7. DIGITAL RECORDER OUTPUT

3-8. To supply Counter display information to HP Model 5050B Digital Recorder, use digital recorder interconnecting cable HP Part No. 10513A. See Section VIII for cable parts list.

CAUTION

Do not connect Digital Recorder cable to rear panel REMOTE PROGRAM connector. Power supply failure will result.

Note

When using HP Model 5050B Digital Recorder with the Counter, press RESET button when FAST/NORM/HOLD switch is set to FAST or when printer is switched from non-operating to operating. When STORAGE switch is OFF, maximum sample rate is 20 ms (NORM) and

is independent of FAST/NORM/HOLD setting. For other records it may be necessary to modify Counter assembly A8 by removing CR30 and grounding the anode of CR41.

3-9. COUNTER INPUT IMPEDANCE

3-10. As illustrated in Figure 3-1, Counter input impedance decreases at higher frequencies. This decrease is due to capacitive loading effect of input amplifier and other stray capacitance in input circuits. If a signal source of fixed impedance is connected to Counter INPUT, a meter at the signal source will not indicate the true input level at the Counter INPUT. To avoid this error, monitor level at Counter INPUT with an RF voltmeter, such as an HP Model 411A, to ensure a satisfactory input level.

Figure 3-1. Typical Input Impedance vs Input Frequency

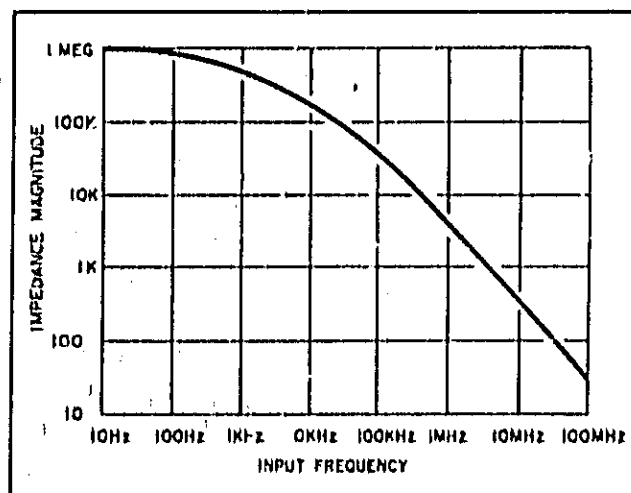
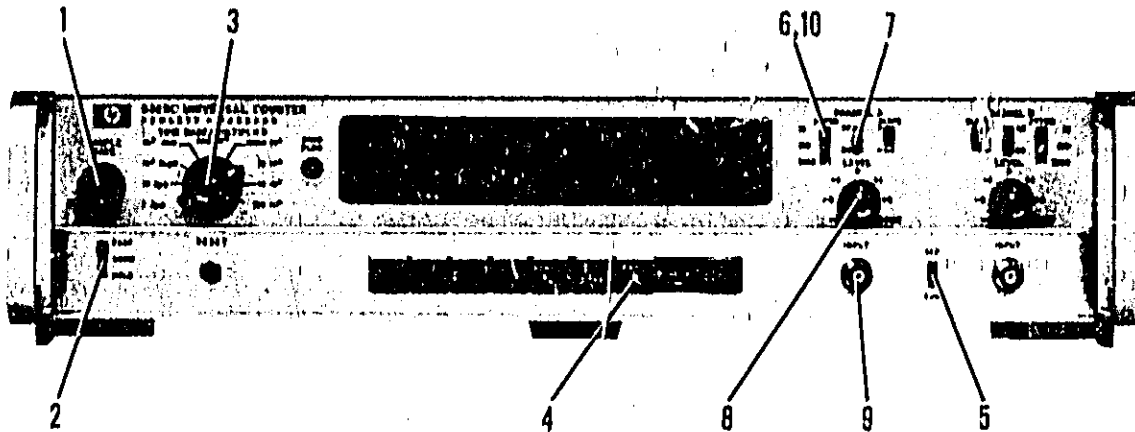


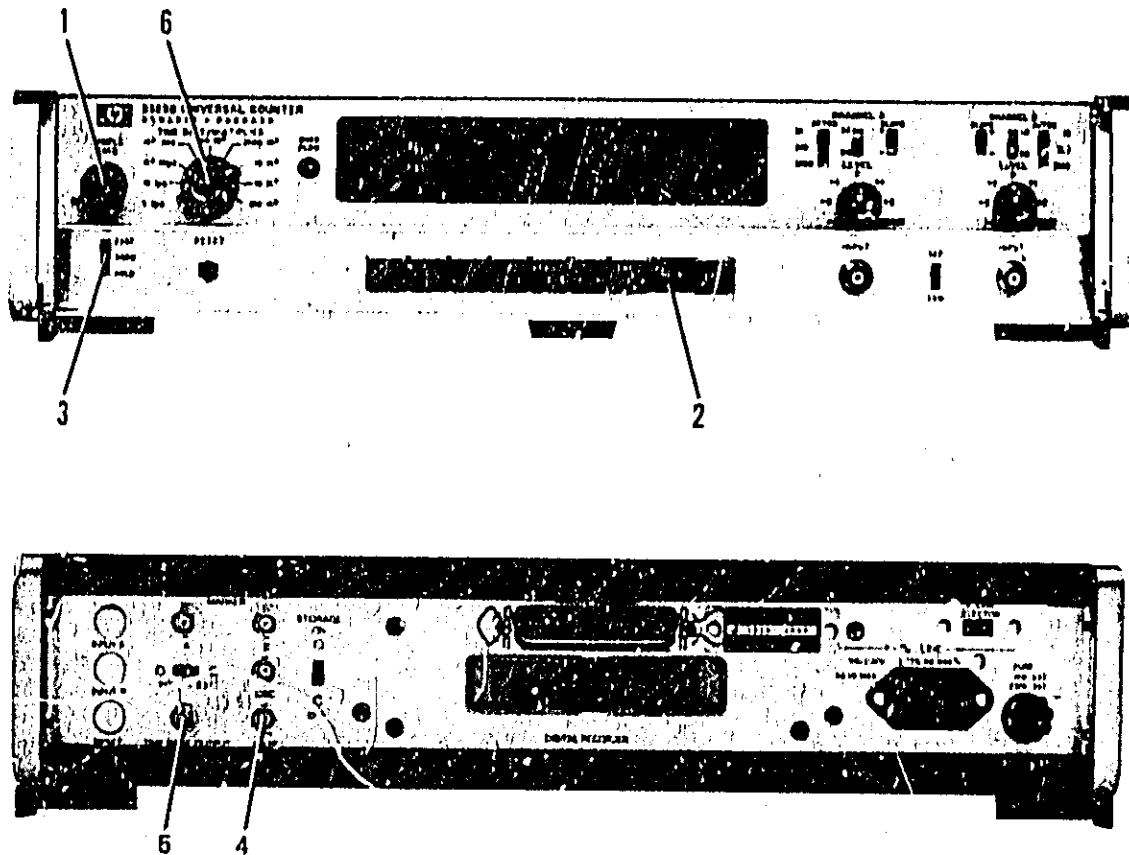
Figure 3-2. Frequency Measurement



FREQ A (Frequency Measurement)

1. Turn Counter on with SAMPLE RATE control.
2. Set FAST/NORM/HOLD switch to NORM.
3. Set TIME BASE/MULTIPLIER to 1 sec. Note: Other gate times may be used.
4. Press FREQ A button.
5. Set COM-SEP switch to SEP.
6. Set CHANNEL A ATTEN to X100.
7. Set CHANNEL A AC-DC switch to AC.
8. Set CHANNEL A LEVEL to PRESET.
9. Connect signal to be counted to CHANNEL A INPUT (10 Hz to 20 MHz).
10. Decrease attenuation with CHANNEL A ATTEN until a stable count is displayed.

Figure 3-3. Self Check

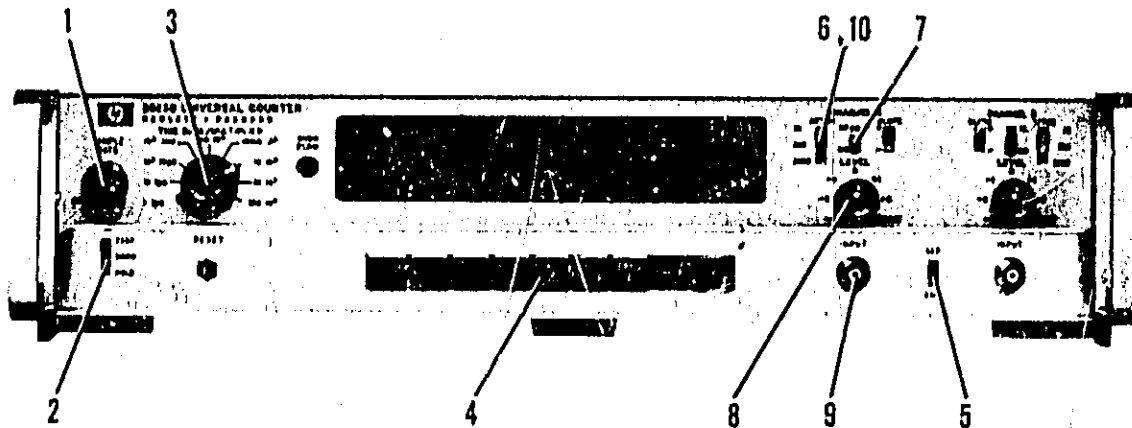


CHECK (Self-Check Operation)

1. Turn Counter on with SAMPLE RATE control.
2. Press CHECK button.
3. Set FAST/NORM/HOLD switch to NORM.
4. Set STORAGE switch to ON.
5. Set INT-EXT switch to INT.
6. Set TIME BASE/MULTIPLIER switch from .1 μ s to 10 sec. Display should be as shown below.

TIME BASE/MULTIPLIER	DISPLAY \pm ONE COUNT	UNITS
.1 μ s	1 .	* (Para. 3-5)
1 μ s	1 0 .	MHz
10 μ s	1 0 . 0	MHz
.1 ms	1 0 . 0 0	MHz
1 ms	1 0 . 0 0 0	MHz
10 ms	1 0 0 0 0 . 0	kHz
.1 sec	1 0 0 0 0 . 0 0	kHz
1 sec	OVERFLOW 0 0 0 0 . 0 0 0	kHz
10 sec	OVERFLOW 0 0 0 . 0 0 0 0	kHz

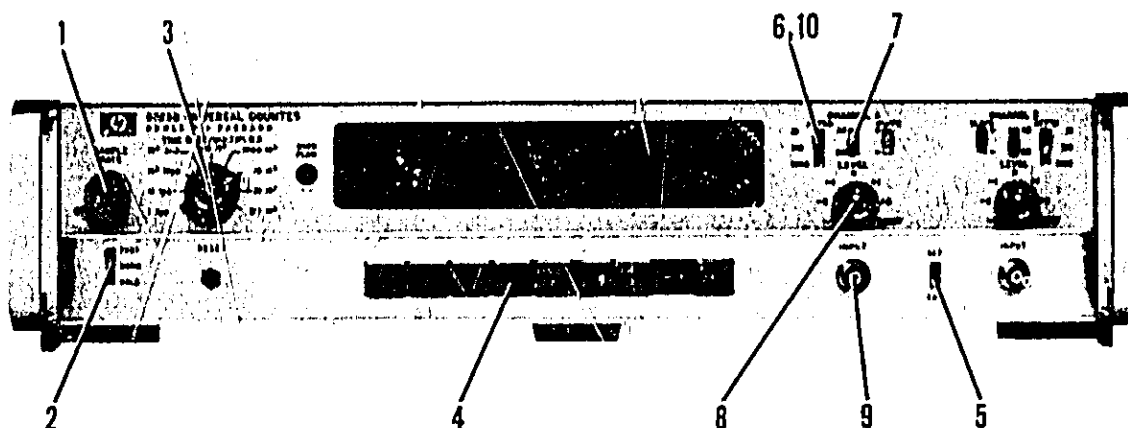
Figure 3-4, Period Measurement



PERIOD A (Period Measurement)

1. Turn Counter on with SAMPLE RATE control.
2. Set FAST/NORM/HOLD switch to NORM.
3. Set TIME BASE/MULTIPLIER to desired counted frequency.
4. Press PERIOD A button.
5. Set COM-SEP switch to SEP.
6. Set CHANNEL A ATTEN to X100.
7. Set CHANNEL A AC-DC switch to AC.
8. Set CHANNEL A LEVEL to PRESET.
9. Connect signal to be counted to CHANNEL A INPUT (10 Hz to 10 MHz).
10. Decrease attenuation with CHANNEL A ATTEN until a stable count is displayed.

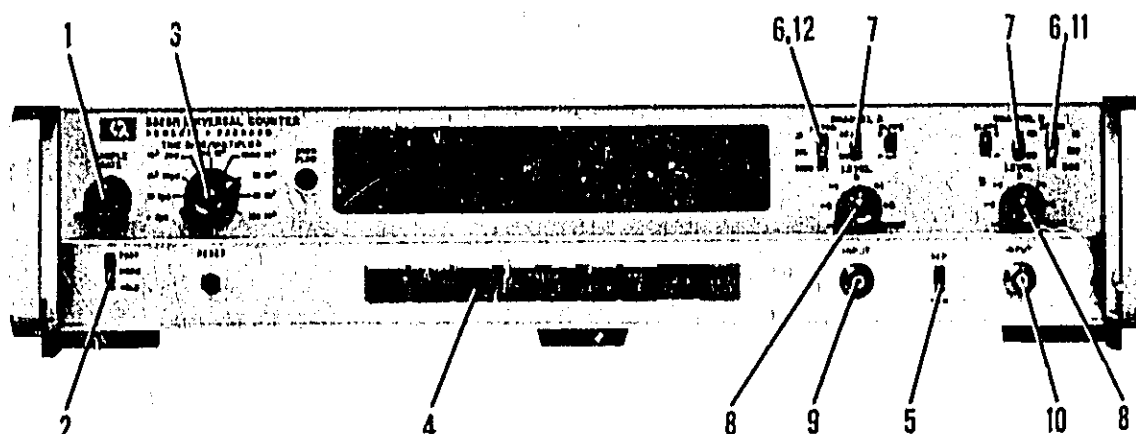
Figure 3-5. Period Average Measurement



PERIOD AVG A (Period Average Measurement)

1. Turn Counter on with SAMPLE RATE control.
2. Set FAST/NORM/HOLD switch to NORM.
3. Set TIME BASE/MULTIPLIER for number of periods to be averaged.
4. Press PERIOD AVG A button
5. Set COM-SEP switch to SEP.
6. Set CHANNEL A ATTEN to X100.
7. Set CHANNEL A AC-DC switch to AC.
8. Set CHANNEL A LEVEL control to PRESET.
9. Connect signal to be counted to CHANNEL A INPUT (10 Hz to 10 MHz).
10. Decrease attenuation with CHANNEL A ATTEN until a stable count is displayed.

Figure 3-6. Ratio Measurement

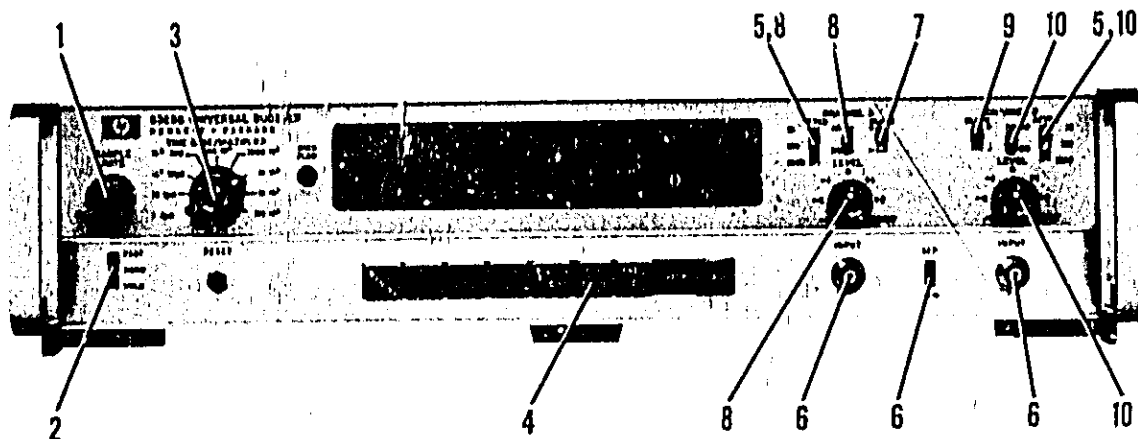


1. Turn Counter on with SAMPLE RATE control.
2. Set FAST/NORM/HOLD switch to NORM.
3. Set TIME BASE/MULTIPLIER for desired ratio multiplier.
4. Press RATIO A/B button.
5. Set COM-SEP switch to SEP.
6. Set CHANNEL A and B ATTEN to X100.
7. Set CHANNEL A and B AC-DC switches to AC.

8. Set CHANNEL A and B LEVEL controls to PRESET.
9. Connect higher frequency to CHANNEL A INPUT (10 Hz to 20 MHz).
10. Connect lower frequency to CHANNEL B INPUT (10 Hz to 10 MHz).
11. Decrease CHANNEL B attenuation until GATE light flashes regularly.
12. Decrease CHANNEL A attenuation until a stable count is displayed.

The Counter display is F_a/F_b ratio. The TIME BASE/MULTIPLIER switch sets the decimal point which determines the display resolution.

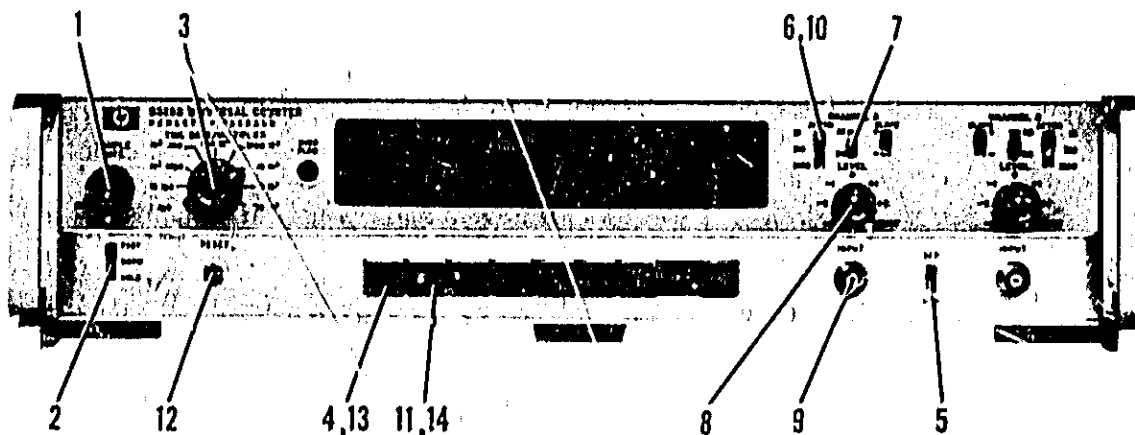
Figure 3-7. Time Interval Measurement



T.I. A to B (Time Interval Measurement)

1. Turn Counter on with SAMPLE RATE control.
2. Set FAST/NORM/HOLD switch to NORM.
3. Set TIME BASE/MULTIPLIER for desired time base.
4. Press T.I. A to B button.
5. Set CHANNEL A and B ATTEN to X100.
6. If start-stop signals are from a common source, connect signal (1 μ s to 10⁸ seconds) to CHANNEL A INPUT and set COM-SEP switch to COM. If start-stop signals are from separate sources, connect start signal to CHANNEL A INPUT, stop signal to CHANNEL B INPUT, and set COM-SEP switch to SEP.
7. Set CHANNEL A SLOPE to + for starting measurement on positive portion of signal; set to - for starting measurement on negative portion of signal.
8. Set CHANNEL A LEVEL and ATTEN to start measurement at desired voltage level. Select AC or DC coupling. Use MARKER A (available at rear panel BNC) to locate starting point of input signal.
9. Set CHANNEL B SLOPE to + for stopping measurement on positive portion of signal; set to - for stopping measurement on negative portion of signal.
10. Set CHANNEL B LEVEL and ATTEN to stop measurement at desired voltage level. Select AC or DC coupling. Use MARKER B (available at rear panel BNC) to locate stopping point of input signal.

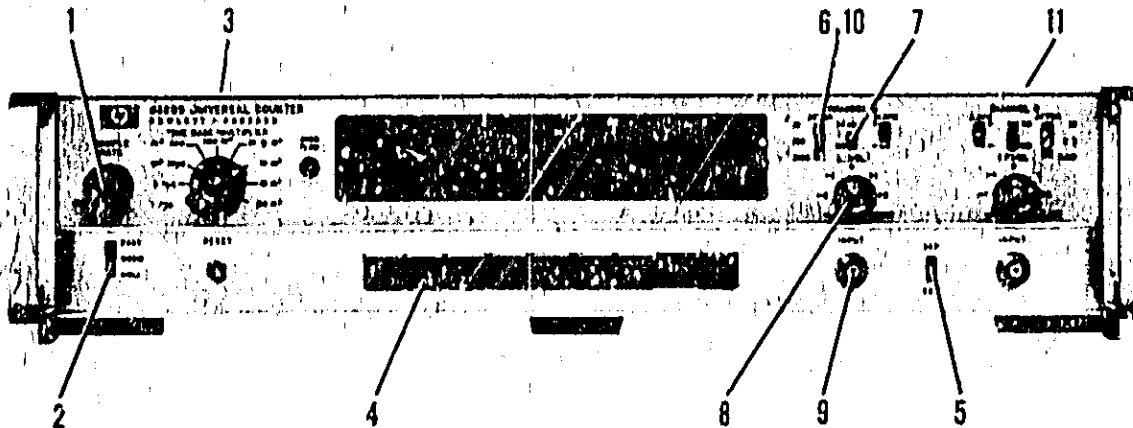
Figure 3-8. Totalizing

**Totalizing Operation (START-STOP)**

1. Turn Counter on with SAMPLE RATE control.
2. Set FAST/NORM/HOLD switch to NORM.
3. Set TIME BASE/MULTIPLIER for desired multiplier.
4. Press START button.
5. Set CCM-SEP switch to SEP.
6. Set CHANNEL A ATTEN to X100.
7. Set CHANNEL A AC-DC switch to AC.
8. Set CHANNEL A LEVEL to PRESET.
9. Connect signal to CHANNEL A INPUT (10 Hz to 10 MHz).
10. Decrease attenuation with CHANNEL A ATTEN until display totalizes steadily.
11. Press STOP button.
12. Press RESET button.
13. To start count, press START button.
14. To stop count, press STOP button.

The total number of events counted is equal to the displayed number multiplied by the setting of the TIME BASE/MULTIPLIER.

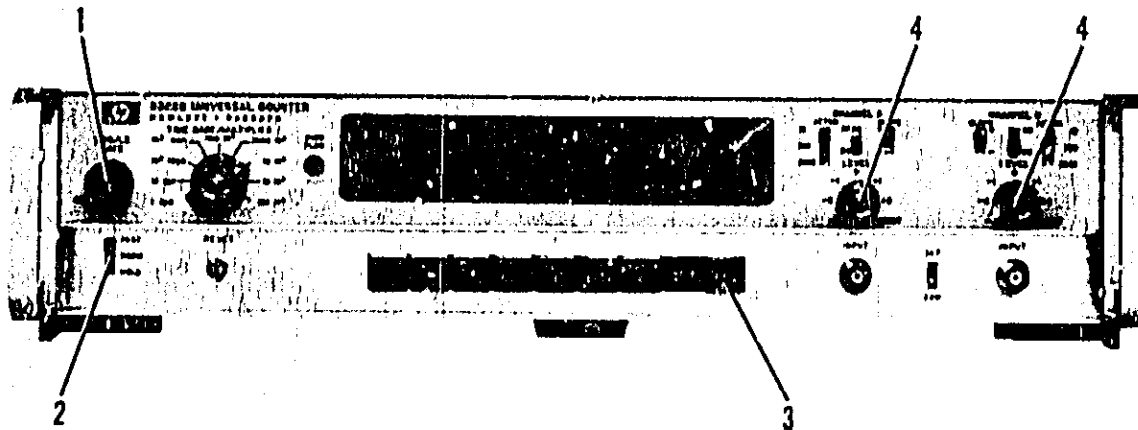
Figure 3-0. Scaler Operation



SCALING OPERATION (Division by 10^0 to 10^8)

1. Turn Counter on with SAMPLE RATE control.
2. Set FAST/NORM/HOLD switch to NORM.
3. Set TIME BASE/MULTIPLIER for desired scaling factor.
4. Press START button.
5. Set COM-SEP switch to SFZ.
6. Set CHANNEL A ATTEN to X100.
7. Set CHANNEL A AC-DC switch to AC.
8. Set CHANNEL A LEVEL to PRESET.
9. Connect signal to CHANNEL A INPUT (10 Hz to 10 MHz).
10. Decrease attenuation with CHANNEL A ATTEN until display counts steadily.
11. Scaled frequency is available at rear TIME BASE OUTPUT BNC.

Figure 3-10. Remote Programming

**EXT (Remote Program Operation)**

1. Set **SAMPLE RATE** control slightly clockwise out of power OFF.
2. Set **FAST/NORM/HOLD** switch to **FAST**.
3. Press **EXT** button. Note: When switching from external to manual operation all external control lines must be open.
4. Set **CHANNEL A** and **B LEVEL** controls to **PRESET**.

The Counter is ready for remote programming. To program a function, ground the appropriate pin on **REMOTE PROGRAM** connector J8. This may be done by contact closure or saturated NPN transistor. Refer to Figure 8-20 and Table 3-2 for connection information.

OPERATING NOTES

DECIMAL POINTS AND MEASUREMENT UNITS. If transistors are used to program these points it should be noted that a floating potential of 200 volts maximum may exist. Therefore transistors with sufficient breakdown characteristics should be used.

SAMPLE RATE. Sample rate is programmed by clamping the "hold" control line J8(33) to ground

for the desired sample rate time. The sample rate period will continue for 100 μ s after the control line is opened.

START-STOP OPERATION. Connect signal to **CHANNEL A INPUT**. To start count, ground J8(21) and J8(30). To stop count, disconnect ground from J8(21) and ground J8(46). Read total count from display. To reset Counter, momentarily open the ground line to J8(30). To operate **START-STOP** function without storage, set the **STORAGE** switch on rear panel to **OFF**.

CHANNEL A AND B LEVEL CONTROLS. An external dc voltage from 0 to ± 3 V is required for programming. The trigger point is equal to the **ATTEN** setting multiplied by the external control voltage. For example, with an external voltage of ± 2 V and the **ATTEN** set to **X10**, the trigger point will be ± 2 volts.

CHANNEL A AND B SLOPE CONTROLS. The **SLOPE** controls must be programmed in order for the amplifier/trigger assemblies to operate.

OPTION 01. If Counter is equipped with Option 01 (programmable attenuator and ac-dc switches) refer to Section VII for operating information.

Table 3-2. Connections to REMOTE PROGRAM Connector J8

FUNCTION	PIN NO.	CONTROL CURRENT MAX (mA)	REMARKS
Function Selector			
STOP	46	4	In this section, one and only one line must be programmed (grounded) for remote operation.
START	21	7	
RATIO A/B	40	5	
PER. AVG A	24	5	
PERIOD A	23	5	
T. I. A to B	48	5	
FREQ A	22	5	
CHECK	47	5	
TIME BASE/MULTIPLIER			
.1 μ s	1	20	In this section, one and only one line must be programmed (grounded) for remote operation.
1 μ s	10	45	
10 μ s	102	10	
.1 ms	103	44	
1 ms	104	18	
10 ms	105	43	
.1 s	106	17	
1 s	107	42	
10 s	108	16	
Units Annunciator Lamps			
kHz	30	2	Floating potential (200 volts max.) with control lines open.
MHz	13	2	
ns	14	2	
μ s	40	2	
ms	15	2	
SEC	41	2	
*	38	2	
Decimal Points			
10 ⁰	2	4	Floating potential (200 volts max.) with control lines open.
10 ¹	27	4	
10 ²	3	4	
10 ³	28	4	
10 ⁴	4	4	
10 ⁵	29	4	
10 ⁶	5	4	
General			
+ SLOPE A	33	1	One of these two must be grounded
- SLOPE A	34	1	
LEVEL A	37		0 to +3 V
+ SLOPE B	32	1	One of these two must be grounded
- SLOPE B	35	1	
LEVEL B	36		0 to +3 V
Sample Rate and Storage			
disable	6	7	See Figure 3-10.
HOLD (Sample Rate)	30	7	
GATE output	11		
Ground	26		Do not program
+5.1 V	1		
+12 V	50		
-12 V	25		

THEORY

SECTION IV THEORY OF OPERATION

4-1. INTRODUCTION

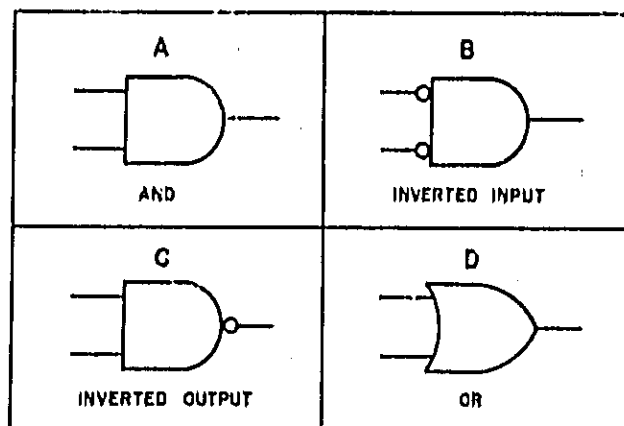
4-2. This section discusses briefly, the operation of individual circuits and assemblies that make up the instrument (starting with Paragraph 4-13). Assemblies are covered in more detail in Section VIII, opposite each schematic diagram. Figures 3-2 through 3-8 outline areas of function selector assembly A4, pertinent to a particular function, and briefly explain circuit configuration. Logic fundamentals are discussed in Paragraphs 4-3 through 4-6. Schematic diagrams are in Section VIII.

4-3. LOGIC PRINCIPLES

4-4. GENERAL. Two states exist in the binary system, 1 and 0. In positive logic, the 1 state is more positive than the 0 state. Positive logic is used in this manual. High (H) and low (L) are used to represent the levels of 1 and 0. HIGH ALWAYS REPRESENTS THE MORE POSITIVE LEVEL, WHETHER IT BE POSITIVE OR NEGATIVE LOGIC. Figure 4-1 shows four types of symbols that have the same truth tables and can be used interchangeably. The same output function is performed by what appears to be two different logic symbols.

4-5. GATES. Figure 4-2A represents a basic AND gate. AND gate output is high if all inputs are high. An AND gate may have two or more inputs. Figure 4-2D represents a basic OR gate. OR gate output is high if one or more of its inputs is high. An OR gate may have two or more inputs.

Figure 4-2. Gate Symbols



4-6. INVERSION. A circle at the input line of a logic symbol indicates a low activates the function. Figure 4-2B shows that a low at both inputs produces a high output. A circle at the output line of a logic symbol, indicates a low when activated, as shown in Figure 4-2C. Thus a circle indicates inversion. An OR gate with inverted output is called a NOR gate. An AND gate with inverted output is called a NAND gate.

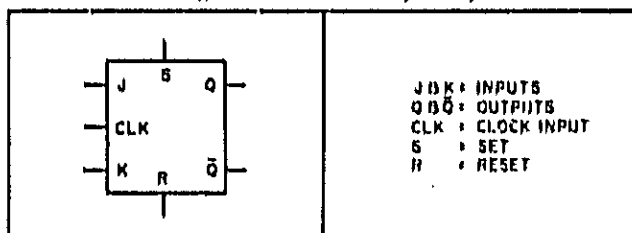
4-7. JK MASTER-SLAVE FLIP-FLOP

4-8. The JK master-slave F-F is basically a bistable MV. With simultaneous high inputs to J and K, before the clock pulse, Q and \bar{Q} will change states after the

Figure 4-1. Logic Comparison Diagrams

A			B			C			D		
A	B	X	A	B	X	A	B	X	A	B	X
H	H	H	H	H	H	H	H	L	H	H	L
H	L	L	H	L	L	H	L	L	H	L	L
L	H	L	L	H	L	L	H	L	L	H	L
L	L	L	L	L	L	L	L	H	L	L	H

Figure 4-3. JK Flip-Flop



clock pulse. Refer to Figure 4-3 and Table 4-1. This circuit triggers on the trailing edge (negative transition) of the clock pulse. The set (S) and reset (R) inputs operate as follows: when a low is applied to set input, Q goes low and Q goes high; when a low is applied to reset input, Q goes low and Q goes high. Set or reset can override all other inputs at any time.

Table 4-1. Truth Table

t_n		$t_n + 1$		t_n = Before clock pulse $t_n + 1$ = After clock pulse
J	K	Q	Q̄	
L	L	Q_n	Q_n	If J = L and K = L, then Q and Q̄ will not change from what they were before the clock pulse.
H	L	H	L	If J = H and K = L, then Q will be H and Q̄ will be L after the clock pulse.
L	H	L	H	If J = L and K = H, then Q will be L and Q̄ will be H after a clock pulse.
H	H	Q_n	Q_n	If J = H and K = H before the clock pulse, then after the clock pulse Q and Q̄ will change states.

4-9. MULTIPLE INPUT JK FLIP-FLOP

4-10. Figure 4-4 illustrates the circuit used for main gate F-F A41C0. It is a JK F-F with multiple input gates at J and K inputs. The triangle shaped symbols represent amplifiers that require a low input to produce a high output. This circuit triggers on the leading edge (positive transition) of the clock pulse.

4-11. ONE-SHOT MULTIVIBRATOR

4-12. The transfer MV uses two NAND gates as shown in Figure 4-5. With no input, gate A (1, 2) is held high by R1, R2, R3, and R4. Gate A (3) is low and gate B (6) is high. When a negative pulse is applied to the input, gate A (1) goes low for a time determined by C1, R1, and R2. At this time gate A (3) goes high and produces a low at gate B (6). This drives A (2) low through C2. C2 now charges through R3 and R4. When C2 has charged sufficiently to allow gate A (2) to go high, pin 3 goes low and permits gate B (6) to return to a high. Thus the output is a negative pulse.

Figure 4-4. Multiple Input JK Flip-Flop

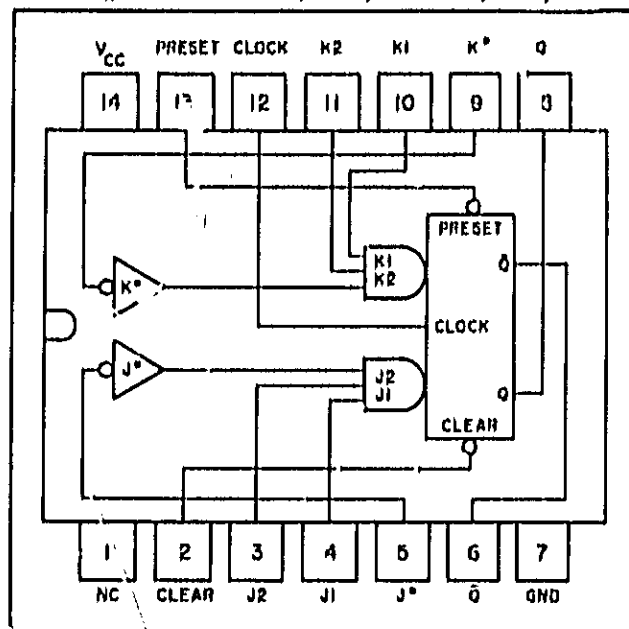
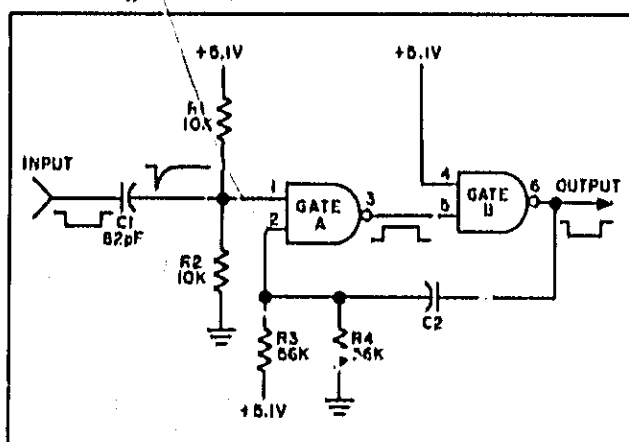


Figure 4-5. One-Shot Multivibrator



4-13. INPUT ATTENUATOR A1

Schematic Diagram Figure 8-16

4-14. This assembly attenuates Channel A and B inputs by factors of 1, 10, or 100 with AC or DC coupling. Input mode is selected by COM-SEP switch S1. With S1 set to COM, Channel A and B are connected at INPUT connectors. When S1 is set to SEP, Channel A and B are independent.

4-15. AMPLIFIER-TRIGGER A2 and A3

Schematic Diagram Figure 8-16

4-16. Amplifier-Trigger assemblies A2 and A3 are identical. This circuit processes the channel A or B input signal, as received from A1, to provide pulse output signals for counting and a stretched pulse output for oscilloscope intensity markers. The circuit consists of an FET input differential amplifier (Q1 A/B, Q2, and Q4), differential Schmitt trigger, and an output one-shot MV. The differential amplifier, coupled with the differential Schmitt trigger, provide

very accurate and stable triggering. R10 balances the differential amplifier and is adjusted for maximum sensitivity at 20 MHz (A2 and A3) with a sine wave input and LEVEL control set to PRESET.

4-17. FUNCTION SELECTOR A4

Schematic Diagram Figure 8-17

4-18. This assembly consists of gates arranged to direct Channel A and B input signals, time base, and 10 MHz signals. Time base and gate output are provided by IC8e and IC1d respectively. This assembly may be programmed from J8 (REMOTE PROGRAM connector) when Function Selector switch S5 is set to EXT. Figures 8-2 through 8-8 illustrate signal path for various functions.

4-19. TIME BASE A5

Schematic Diagram Figure 8-18

4-20. GENERAL. The A5 time base assembly receives the 10 MHz A7 oscillator signal or the CHANNEL A or B INPUT signal through the A4 function selector. Depending on the setting of the TIME BASE/MULTIPLIER switch S4, the A5 input signal is passed through without division, or it is divided by 10 by 10^8 . This assembly may be programmed from J8 (REMOTE PROGRAM connector) when Function Selector switch S5 is set to EXT.

4-21. DUAL DECADE DIVIDERS. IC's 1 to 4 are dual-section (A and B) decade dividers, cascaded to divide inputs by 10^1 to 10^8 . Section A: for 10 pulses in pin 2, 1-pulse exits pin 4. When pin 14 goes low, grounded by TIME BASE/MULTIPLIER switch, the divided by 10 output is also at pin 13. When pin 16 is high, the decade is reset to 0. When the EXT push-button (S6) is depressed, the DC control lines to the decade dividers are controlled from the REMOTE PROGRAM connector, J8. Section B: Section B duplicates A (see IC diagram for pins).

4-22. CRYSTAL/OVEN A6

Schematic Diagram Figure 8-19

4-23. This assembly contains the 10 MHz crystal for oscillator/multiplier assembly A7, and heater RT1 which maintains crystal temperature. The heater operates on 24 volts (+12 V and -12 V supplied by A10).

4-24. OSCILLATOR/MULTIPLIER A7

Schematic Diagram Figure 8-10

4-25. This assembly includes a 10 MHz oscillator, 10 MHz multiplier, output one-shot MV, and a driver. Oscillator frequency and crystal current are adjusted by C5 and R6 respectively. The 10 MHz multiplier consists of two tuned amplifiers whose output is shaped by output one-shot Q7 and Q8. Driver Q9 provides positive pulses at pin 3. With INT-EXT switch S8 set to EXT, operating voltage for oscillator is disconnected and external standard frequency is connected to OSC jack on rear panel.

4-26. COUNTER BOARD A8

Schematic Diagram Figure 6-20

4-27. GENERAL. This assembly includes circuits for: GATE and OVERFLOW lamps, sample rate, print command, transfer, reset, counting, and storage. See timing diagram Figure 4-6.

4-28. GATE LIGHT. The GATE light indicates when main gate (Q20 and Q21) is open. Gate light driver Q2 receives input from main gate F-F A4IC0 and gate light one-shot Q5 and Q6. During short gate times, the gate light one-shot ensures a visible flash from the GATE light.

4-29. OVERFLOW LIGHT. The OVERFLOW light indicates when the last decade counter (IC7) has exceeded nine counts. A positive pulse appears at IC7(8) when it changes from 9 to 0. This signal is received by Q9 and triggers NAND gate F-F IC18c, d. When the transfer pulse occurs, a positive pulse is applied to IC18a(5) and IC18b(0). This signal permits NAND gate F-F IC17c, d to assume the state of the preceding F-F (IC18c, d), and OVERFLOW lamp is turned on. After sample rate period, a reset pulse is applied to the first NAND gate F-F to set it for the next cycle.

4-30. SAMPLE RATE. When the main gate closes at end of gate time, IC15b is triggered. IC15b(10) goes low and applies hold-off to main gate F-F (A4IC0). This also drives the main gate and time base inhibit circuit Q18. Q19. IC15b(11) goes high and provides clock input for IC15a, if printer inhibit is not present. When IC15a is triggered, pin 15 goes high and turns on Q10 and Q13. This gives print command and starts sample rate run-down circuits. IC15a(14) goes low and triggers transfer one-shot.

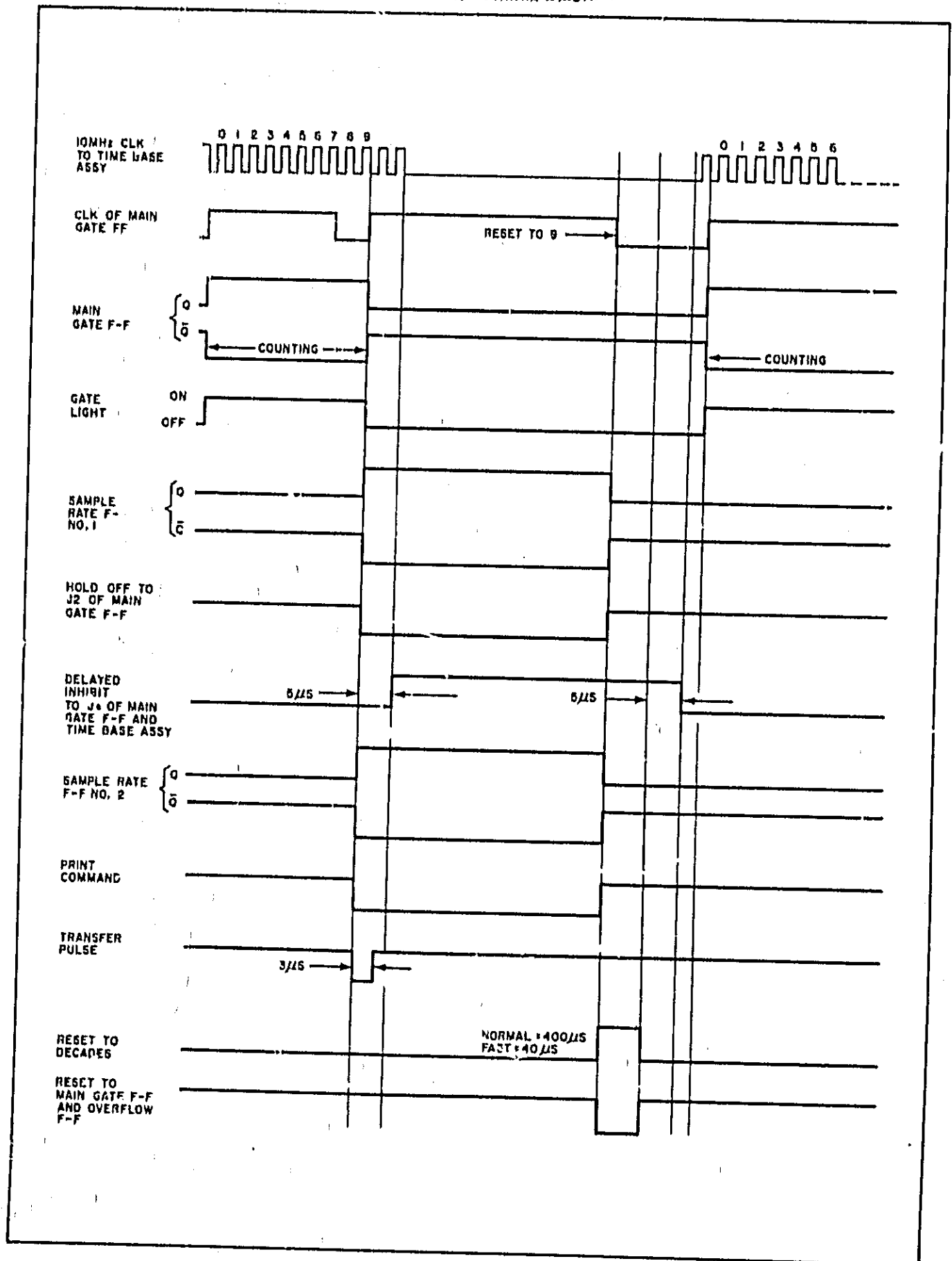
4-31. At end of sample rate period, IC15a, b are reset by IC16d. When IC15a and b are reset, they trigger reset one-shot (Q11, Q12, and Q14).

4-32. PRINT COMMAND. When main gate Q20, Q21 closes at end of gate time, Q10 is turned on and provides a +5 V to 0 V step (print command signal) at A8J2(D).

4-33. TRANSFER. The transfer one-shot MV is triggered when IC15a(14) goes low, at end of gate time. When triggered, IC16b(8) goes high and releases information in overflow storage circuits. At this time IC17b(3) goes low and transfers count from decade counters (IC1 through IC7) to buffer storage units (IC8) through IC14).

4-34. RESET. After sample rate period, the reset one-shot is triggered by IC15a and b. At this time Q14 collector goes high and turns on reset amplifier Q17. Q17 resets decade counter IC1 through IC7 to zero, and time base dividers A5IC1 through IC8 to nine. At the same time, Q11 collector goes low and resets overflow storage F-F (IC18c, d) and main gate F-F A4IC0.

Figure 4-6. Timing Diagram



4-35. The reset one-shot is also triggered (via reset trigger circuit Q7 and Q8) when RESET button S3 is pressed or when Function Selector switch S5 is switched from one function to another.

4-36. **DECADE COUNTERS.** When main gate is open, IC1 through IC7 count the number of pulses and provide a four-line BCD code to buffer storage unit IC8 through IC14. When pin 10 of a decade counter goes low, the display tube for that decade is blanked. Pin 10 of each decade counter is controlled by its respective "blanking encoder" circuit.

4-37. Decade counter IC1 is a high-speed (greater than 10 MHz), non-blanking decade. All decade counters receive input on pin 9 and supply a divide-by-10 output on pin 8. The decades provide -8421 (DCBA) BCD output to buffer storage circuits.

4-38. **MAIN GATE.** Q20-21 make up a two-input AND gate. When Q21 base goes low, the transistor is cut-off and gate is open. Now, pulses at Q21 base will appear at the collector (gate output). From here, the pulses pass on to driver Q22, Q23 and decade counters.

4-39. **BLANKING ENCODERS.** Pin 10 of each decade counter is controlled by its respective blanking encoder circuit. IC19-IC20, IC19 and IC20 are identical six-section inverters. In this circuit the inverters provide blanking of the display zeros to the left of the significant digit. Each circuit receives input from TIME BASE/MULTIPLIER switch S4 (which works in conjunction with Function Selector switch S5) or REMOTE PROGRAM connector J8, and the preceding encoder circuit.

4-40. For example, with TIME BASE/MULTIPLIER switch S4 set to 10 s, and Function Selector switch S5 set to PERIOD AVG A, IC20(11), inverter E, base will go low and the inverter E output will go high. This will allow the display tube for IC6 to be unblanked and at the same time will couple the signal to the preceding blanking encoder circuit D through inverter B.

4-41. **BUFFER STORAGE UNITS.** These units have four inputs and eight outputs. Four of the output lines carry coded information to decoder drivers on display assembly A9. The other four outputs are +8421 BCD code for DIGITAL RECORDER connector on rear panel. When STORAGE switch S9 is ON, pin 5 of buffer storage units is held high. This prevents information in decade counters from reaching the buffer storage units. At transfer time, pin 5 goes low, and information in decade counters passes through buffer storage circuits and on to decoder drivers (A9IC1 through IC7).

4-42. DISPLAY BOARD A9

Schematic Diagram Figure 8-21

4-43. This assembly consists of decoder drivers IC1 through IC7 and digital display tubes DS1 through DS7. The decoder drivers are 4- to 10-line decoders. A low from decoder driver to a number in digital display tube will light that number. The digital display tubes also contain the decimal points. Decimal points are controlled from A8 and may be remote programmed from J8.

4-44. +12 VOLT SUPPLY A10

Schematic Diagram Figure 8-22

4-45. This assembly supplies +12 V and -12 V. The two regulator circuits depend on each other for operating bias. The -12 V supply also gives bias to +5.1 V regulator on A11. If the +12 V or -12 V regulator is overloaded, it will turn off the other regulator. This, in turn, will shut off the regulator being overloaded. To restore power, reset switch S1 must be momentarily closed, or ac line voltage interrupted.

4-46. +175 AND +5.1 VOLT SUPPLY A11

Schematic Diagram Figure 8-22

4-47. This circuit supplies +5.1 V and +175 V. The +175 volt supply goes to display board A9 and operates the digital display tubes. The +5.1 V supply is used primarily to operate integrated circuits throughout the instrument.

4-48. UNITS ANNUNCIATOR A12

Schematic Diagram Figure 8-21

4-49. This assembly has eight neon lamps on right of display. Lamps are designated: MHz, kHz, SEC, ms, μ s, ns, * (asterisk), and GATE. With the exception of GATE lamp DS8, all lamps are controlled by TIME BASE/MULTIPLIER switch S4 and Function Selection switch S5. This assembly may be programmed from J8 (REMOTE PROGRAM connector) when Function Selector switch S5 is set to EXT.

MAINTENANCE

SECTION V MAINTENANCE

5-1. INTRODUCTION

5-2. This section gives maintenance and service information. Included is a table of recommended test equipment, disassembly and repair procedures, and an in-cabinet performance check which may be used to verify proper operation of the Counter. Troubleshooting and adjustment information is located in Section VIII, opposite each schematic diagram.

5-3. ASSEMBLY DESIGNATIONS

5-4. Table 5-1 lists the designations and name of assemblies used in this instrument. See Section VI for part numbers.

Table 5-1. Assembly Identification

Assy	Name	HP Part No.
A1	Input Attenuator	05325-60040
A2, A3	Amplifier/Trigger	05325-60035
A4	Function Selector	05325-60046
A5	Time Base	05325-60048
A6	Crystal/Oven	05325-60012
A7	Oscillator/Multiplier	05325-60050
A8	Counter Board	05325-60047
A9	Display Board	05325-60011
A10	± 12 V Supply	05325-60005
A11	+175 & +5.1 V Supply	05323-60022
A12	Units Annunciator	05325-60010

5-5. TEST EQUIPMENT

5-6. Test equipment recommended for maintaining and checking performance of instrument is listed in Table 5-2. Test equipment having equivalent characteristics may be substituted for the equipment listed.

5-7. ASSEMBLY CONNECTION IDENTIFICATION

5-8. Throughout the manual, connections to printed circuit assemblies are referred to in abbreviated form. For example, connection to A5 pin 3 is A5(3).

5-9. IN-CABINET PERFORMANCE CHECK

5-10. GENERAL. The performance check in Table 5-3, and test card verify proper operation of all circuits in the Counter and may be used:

a. As part of an incoming inspection check of instrument specifications.

b. Periodically, for instruments used in systems where maximum reliability is important.

c. As part of a procedure to locate troublesome circuits.

d. After any repairs or adjustments, before returning instrument to regular service.

5-11. VARIABLE LINE VOLTAGE. During the following tests (Table 5-3), the Counter should be connected through a variable voltage source so that line voltage may be varied $\pm 10\%$ from nominal (115 or 230 Vac) to assure proper operation under these supply conditions.

5-12. INSTRUMENT COVER REMOVAL

5-13. To remove top, bottom, or side covers, remove phillips-head screws, and slide top and bottom covers toward rear of instrument. To replace cover, reverse procedure.

WARNING

115/230 VAC AND +175 VDC SUPPLY WIRES ARE EXPOSED WHEN EITHER TOP OR BOTTOM COVER IS REMOVED. USE EXTREME CAUTION DURING TROUBLESHOOTING, ADJUSTMENT, OR REPAIR. AVOID DAMAGE TO INSTRUMENT BY REMOVING POWER BEFORE REMOVING OR REPLACING COVERS, ASSEMBLIES OR COMPONENTS.

5-14. REMOVAL OF PRINTED CIRCUIT BOARDS

5-15. COUNTER BOARD A8. To remove this board:

a. Remove top cover (see Paragraph 5-12).

b. Disconnect all clip-on wires from board.

c. Remove the five screws that secure board to chassis.

d. Slide board toward rear of instrument until connector on front of board disengages from display board connector.

e. Now lift the front of the board slightly while sliding it toward front of instrument, and remove.

f. Replace board by reversing procedure.

Note

When replacing boards with clip-on wires, be sure wires are connected correctly by observing color codes next to each pin.

5-16. DISPLAY BOARD A9. To remove this board:

- a. Perform steps a, c, and d (see Paragraph 5-15).
- b. Disconnect all clip-on wires from board, except those coming from annunciator board A12.
- c. Remove four screws securing board to chassis.
- d. Lift front of counter board and slide display board toward rear of instrument.
- e. Now lift front of display board up and out.
- f. Replace board by reversing procedure.

5-17. UNITS ANNUNCIATOR BOARD A12. To remove this board:

- a. Remove top cover.
- b. Disconnect clip-on wires on display board that come from the annunciator board.
- c. Remove the two screws that hold board to readout block, and remove. Note: It may be necessary to remove additional wires from the display board to gain access to lower screw on the annunciator board.
- d. Replace board by reversing procedure.

Table 5-2. Recommended Test Equipment

Instrument Type	Required Characteristics	Recommended Type
Plug-in Oscilloscope Dual Trace Plug-in Horizontal Plug-in	50 MHz bandwidth 5 mV/cm sensitivity	HP Model 180A HP Model 1801A HP Model 1820A
Divider Probe	10:1, 10 pF, dc to 40 MHz	HP Model 10003A
Divider Probe	50:1, 5 pF, dc to 30 MHz	HP Model 10002A
Current Probe Current Probe Amp	1 mV/mA sensitivity, $\pm 3\%$	HP Model 1110A HP Model 1111A
Test Oscillator	10 Hz to 10 MHz at 100 mV	HP Model 651B
Pulse Generator	± 50 ns, 0.3 V at 100 kHz	HP Model 222A
RF Signal Generator	10 MHz to 20.0 MHz, 100 mV	HP Model 606B
DC VTVM	0 to ± 300 Vdc, $\pm 1\%$, 200 megohm impedance	HP Model 412A
AC VTVM	1 mV to 300 V, 10 Hz to 10 MHz, $\pm 5\%$	HP Model 3400A
Digital Recorder Digital Recorder Interconnecting Cable	Must be compatible with Counter.	HP Model 5050B HP Model 10513A
Electronic Counter	dc to 50 MHz, plug-in capability	HP Model 5248L
Extender Board	15 pin male to 15 pin female	HP Part 5060-0049 supplied with Counter
50 Ω Feedthru Termination	Male to female BNC	HP Model 10100A
BNC "T" Connector		HP Part 1250-0781
1 MHz Frequency Standard	Stability, ± 1 part in 10^8 /month	HP Model 107AR

5-18. REPAIR

5-19. Printed Circuit Component Replacement

5-20. Component lead-holes in the circuit boards have plated walls to ensure good electrical contact between conductors on opposite sides of the board. To prevent damage to this plating and the replacement component, apply heat sparingly, and work carefully. The following replacement procedure is recommended:

- Remove defective component.
- Melt solder in component lead-holes. Use clean, dry soldering iron to remove excess solder. Clean holes with a wooden toothpick or splinter. Do not use metal tool for cleaning as this may damage through-hole plating.
- Bend leads of replacement component to the correct shape and insert into component lead holes. Using heat and solder sparingly, solder leads in place. Heat may be applied to either side of board.

4. Through-hole plating breaks are indicated by separation of the round conductor pad from either side of the board. To repair breaks, press conductor pad against board and solder replacement component lead to conductor pad on both sides of board.

5-21. Replacing Integrated Circuits

5-22. Following are two recommended methods of replacing integrated circuits:

- Solder Gobbler.** This is the best method. Solder is removed from the board by a soldering iron with a hollow tip connected to a vacuum source. This permits an IC to be removed intact so that it may be replaced if an error has been made in diagnosis.
- Clip Out.** This method should be used as a last resort only. Clip the leads as close to the case as possible. With a soldering iron and long nose pliers, carefully remove the wires from each hole. Clean holes as described in Paragraph 5-20 step b.

Table 5-3. In-Cabinet Performance Check

START (Totalizing and Scaling)

RANGE: 0-10 MHz

- Set Counter controls as follows:

SAMPLE RATE	clockwise out of OFF.
FAST/NORM/HOLD	NORM
TIME BASE/MULTIPLIER1 μ s
Function Selector	START
COM-SEP	SEP
CHANNEL A	
ATTEN	X1
AC-DC	DC
LEVEL	PRESET

- Connect Test Oscillator to CHANNEL A INPUT.
- Connect an Electronic Counter to rear-panel TIME BASE jack. Counter should be DC coupled and set to trigger on positive slope.
- Set Oscillator to 10 MHz at 1 V rms. The Test Counter should display 10 MHz.
- Set TIME BASE/MULTIPLIER to each position while observing Test Counter. The frequency should decrease by a factor of 10 for each successive setting of the TIME BASE/MULTIPLIER switch. This check may be made at any frequency from 0 to 10 MHz. Record on test card.

FREQUENCY

- RANGE: 0 to 20 MHz

- Set Counter controls as follows:

SAMPLE RATE	mid range
FAST/NORM/HOLD	FAST
TIME BASE/MULTIPLIER	1 s
Function Selector	FREQ A
COM-SEP	SEP
STORAGE (rear panel)	ON
CHANNEL A and B	
ATTEN	X1
AC-DC	DC
LEVEL	PRESET

Table 5-3. In-Cabinet Performance Check Cont'd.

FREQUENCY CONT'D

1. RANGE Cont'd.

- b. With a BNC "T" connect Test Oscillator to CHANNEL A INPUT and Oscilloscope input. Use Oscilloscope to monitor Counter input level.
- c. Vary input frequency from 10 Hz to 20 MHz keeping input level at .1 V rms (.28 V p-p). The Counter should properly display all frequencies in this range. Record on test card.
- d. Set FAST/NORM/HOLD switch to NORM. GATE light should flash regularly. Set FAST/NORM/HOLD switch to HOLD. Counter display should remain constant and GATE light should go out.
- e. Apply 10 kHz at 1 V rms to CHANNEL A INPUT, and connect Oscilloscope (using X10 probe and 500Ω load) to MARK 7 A output jack on rear panel. Oscilloscope should display negative pulses, >5V volts in amplitude and <0.7 μs wide at 50% of maximum amplitude. Repeat this test for CHANNEL B INPUT.
- f. Connect DC VTVM to GATE output jack on rear panel. Set Function Selector on Counter to STOP. The VTVM should read +4 V (gate closed). Set Function Selector to START; VTVM should read 0 V (gate open).

2. SENSITIVITY: .1 V rms (.28 V p-p)

Sensitivity is checked by procedure of Item 1 under FREQUENCY. Record on test card.

TIME INTERVAL

This test measures the accuracy of the T, I. A to B function (time interval - Channel A input to Channel B input). A Hewlett-Packard Model 5248L Electronic Counter is the primary test equipment. The 5248L rear panel OUTPUT STD. FREQ. connector provides an extremely accurate square wave signal. This signal is not equal time positive and negative.

It is very close to 60% + and 40% negative, but the total time for one complete cycle is very accurate.

Test Procedure

Set the 5248L Counter controls as follows:

Set the 5325B Counter controls as follows:

Control	Setting
SAMPLE RATE	Mid-Scale
FAST/NORM/HOLD	NORM
TIME BASE/MULTIPLIER	See Test Table
Function Selector	T, I. A to B
SEP-COM	COM
CHANNEL A and CHANNEL B	
ATTEN	X1
AC-DC	AC
SLOPE	See Test Table

Control (front panel)	Setting
SAMPLE RATE	HOLD
INPUT SIGNAL	AC
SENSITIVITY (Volts rms)	1
-LEVEL+	PRESET
TIME BASE	ANY
FUNCTION	FREQUENCY
Control (rear panel)	
MODE	INT STD FREQ
OUTPUT STD FREQ	See Test Table
STORAGE-CFF	STORAGE

Table 5-3. In-Cabinet Performance Check Cont'd.

TIME INTERVAL CONT'D					
Connect a coaxial cable from the 5248L rear panel OUTPUT STD FREQ jack to the 5325B CHANNEL A INPUT jack through a 50Ω termination. Change the 5325B Counter control settings as shown on the numbered lines of the Test Table and note the 5325B nixie display indication. Any difference between the Test Table Display column and the 5325B nixie display indication should be equal to or be smaller than the total of the 5325B and 5248L specified allowable errors.					
<u>NOTE:</u> Push 5325B Reset button before each reading.					
TEST TABLE					
STEP	5248L/M (REAR PANEL)	5325B PANEL			
		TIME BASE/ MULTIPLIER	CHANNEL SLOPE		DISPLAY READING
			A	B	
1	.1 Hz	10 s	+	+	1 Sec. *
2	.1 Hz	10 s	+	-	1 Sec. *
3	.1 Hz	10 s	-	+	1 Sec. *
4	.1 Hz	1 s	+	+	10 Sec.
5	.1 Hz	1 s	+	-	6 Sec.
6	.1 Hz	1 s	-	+	4 Sec.
7	.1 Hz	.1 s	+	+	10.0 Sec.
8	.1 Hz	.1 s	+	-	6.0 Sec.
9	.1 Hz	.1 s	-	+	4.0 Sec.
10	1 Hz	10 ms	+	+	1.00 Sec.
11	1 Hz	10 ms	+	-	.60 Sec.
12	1 Hz	10 ms	-	+	.40 Sec.
13	1 Hz	10 ms	+	+	1000 ms
14	1 Hz	1 ms	+	-	600 ms
15	1 Hz	1 ms	-	+	400 ms
16	1 Hz	.1 ms	+	+	1000.0 ms
17	1 Hz	.1 ms	+	-	600.0 ms
18	1 Hz	.1 ms	-	+	400.0 ms
19	10 Hz	10 μs	+	+	100.00 ms
20	10 Hz	10 μs	+	-	60.00 ms
21	10 Hz	10 μs	-	+	40.00 ms
22	100 Hz	1 μs	+	+	10000 μs
23	100 Hz	1 μs	+	-	6000 μs
24	100 Hz	1 μs	-	+	4000 μs
25	100 Hz	.1 μs	+	+	10000.0 μs
26	100 Hz	.1 μs	+	-	6000.0 μs
27	100 Hz	.1 μs	-	+	4000.0 μs

Table 5-3. In-Cabinet Performance Check Cont'd.

PERIOD

RANGE: 0 to 10 MHz

- a. Set Counter controls as follows:

SAMPLE RATE	clockwise out of OFF
FAST/NORM/HOLD	NORM
TIME BASE/MULTIPLIER1 μ s
Function Selector	PERIOD A
COM-SEP	SEP
CHANNEL A	
ATTEN	X1
AC-DC	DC
LEVEL	PRESET
CHANNEL A SLOPE	+
CHANNEL B SLOPE	-

- b. Connect Test Oscillator to CHANNEL A INPUT. During the following test keep the output level at 1 V rms.

PERIOD AVERAGE

RANGE: 0 to 10 MHz

- a. Set Counter controls as follows:

SAMPLE RATE	clockwise out of OFF
FAST/NORM/HOLD	NORM
TIME BASE/MULTIPLIER1 μ s
Function Selector	PERIOD AVG A
COM-SEP	SEP
CHANNEL A	
ATTEN	X1
AC-DC	DC
LEVEL	PRESET
CHANNEL A SLOPE	+
CHANNEL B SLOPE	-

- b. Connect Test Oscillator to CHANNEL A INPUT. During the following test keep the output level at 1 V rms.

RATIO A/B

RANGE: Channel A: 0 to 20 MHz

Channel B: 0 to 10 MHz

- a. Set Counter controls as follows:

SAMPLE RATE	clockwise out of OFF
FAST/NORM/HOLD	NORM
TIME BASE/MULTIPLIER1 μ s
Function Selector	RATIO A/B
COM-SEP	SEP
CHANNEL A and B	
ATTEN	X1
AC-DC	DC
LEVEL	PRESET

- b. Connect 10 MHz at 1 V rms to CHANNEL B INPUT.
- c. Connect 20 MHz at 1 V rms to CHANNEL A INPUT.
- d. Set TIME BASE/MULTIPLIER switch to each position. Counter display should be as shown on following page.

Table 5-3. In-Cabinet Performance Check Cont'd.

RATIO A/B Cont'd.

TIME BASE/MULTIPLIER	DISPLAY
1	1
10	1.2
10 ²	1.25
10 ³	1.250
10 ⁴	1.2500
10 ⁵	1.25000
10 ⁶	1.250000
10 ⁷	OVERFLOW .2500000
10 ⁸	OVERFLOW .5000000 *

NOTE

The asterisk displayed in the 10 s position of the TIME BASE/MULTIPLIER switch indicates display must be multiplied by .1.

TIME BASE

1. STABILITY: Aging rate: ≤ 3 parts in 10^{-7} per month after 14 days continuous operation with line voltage and temperature constant.
 Temperature: $\leq \pm 2.5$ parts in 10^6 , 0° to $+50^\circ\text{C}$.
 Line Voltage: $\leq \pm 1$ part in 10^7 for a 10% line voltage change.

a. Set Counter controls as follows:

SAMPLE RATE clockwise out of OFF
 FAST/NORM/HOLD NORM
 TIME BASE/MULTIPLIER 10 s
 Function Selector FREQ A
 COM-SEP SEP

CHANNEL A

ATTEN X1
 AC-DC DC
 LEVEL PRESET

NOTE

Allow 3 hour warm up period before proceeding to the next step.

- b. Connect 1 MHz standard to CHANNEL A INPUT.
- c. A Counter display of 000,0000 kHz (most significant digit not displayed) indicates that Counter time base frequency is exactly 10 MHz. Offset between Counter time base and 1 MHz standard (parts in 10^7) may be calculated as shown below.

COUNTER DISPLAY	TIME BASE OFFSET
000,0000 kHz	0 parts in 10^7
000,0003 kHz	-3 parts in 10^7
999,9997 kHz	+3 parts in 10^7

- d. Record frequency offset determined in step c. For long term stability this test should be made daily for one month.

NOTE

Temperature must be kept constant or compensation for temperature difference must be made whenever a frequency difference is recorded. Unless a record of the temperature and date of last calibration is available, the frequency offset should not be considered drift or aging rate of the 10 MHz crystal.

Table 5-3. In-Cabinet Performance Check Cont'd.

TIME BASE Cont'd.

- c. Vary line voltage $\pm 10\%$ and record frequency difference on test card.
- f. Vary operating temperature from 0° to $+50^\circ\text{C}$ and record frequency difference.
- 2. **OSCILLATOR OUTPUT:** 10 MHz, 1V p-p at OSC jack on rear panel
 - a. Connect Oscilloscope vertical input to OSC jack on Counter.
 - b. Oscilloscope should display a 10 MHz nonsinusoidal wave 1V p-p.
- 3. **EXTERNAL INPUT:** 1V rms at 1, 2.5, 5, or 10 MHz
 - a. Set INT-EXT switch to EXT, and Function Selector to CHECK.
 - b. Connect Test Oscillator to OSC jack on rear panel. During the following test keep output level at 1V rms.
 - c. Set Test Oscillator to 1, 2.5, 5, and 10 MHz respectively and observe that Counter self checks normally.

DIGITAL OUTPUT

CAUTION

Do not connect Digital Recorder cable to rear-panel REMOTE PROGRAM connector. Power supply failure will result.

CODE: 8-4-2-1 "1" state positive "0" level: $+0.25\text{V (low)} = -1\text{ mA}$
 $+0.4\text{V (low)} = -5\text{ mA}$
 "1" level: $+5\text{V open circuit, } 2.5\text{K source impedance}$

- a. Set Counter controls as follows:

SAMPLE RATE	clockwise out of OFF
FAST/NORM/HOLD	NORM
TIME BASE/MULTIPLIER1 μs
Function Selector	START
CHANNEL A	
ATTEN	X1
AC-DC	DC
LEVEL	PRESET
- b. Connect Digital Recorder to Counter with HP 10513A cable.
- c. Connect Test Oscillator to CHANNEL A INPUT and vary input frequency from 10 Hz to 10 MHz (while holding printer record switch down). Observe that all digits in each column of the printer are displayed correctly. Record on test card.

PERFORMANCE CHECK TEST CARD

Hewlett-Packard Model 5325B Universal Counter		Tests Performed by _____	
Serial No. _____		Date _____	
DESCRIPTION		CHECK	
START Range: 0 to 10 MHz		<input type="checkbox"/> 10 Hz to 10 MHz	
FREQUENCY 1. Range: 0 to 20 MHz d. FAST/NORM/HOLD e. MARKER A and B f. GATE output 2. Sensitivity: 0.1 V rms (.28 V p-p)		<input type="checkbox"/> 10 Hz to 20 MHz <input type="checkbox"/> 0.1 V rms	
TIME INTERVAL Range: .1 μ s to 10^8 seconds		<input type="checkbox"/> .1 μ s to 10^2 seconds	
PERIOD Range: 0 to 10 MHz		<input type="checkbox"/> 10 Hz to 5 MHz	
PERIOD AVERAGE Range: 0 to 10 MHz		<input type="checkbox"/> 10 Hz to 5 MHz	
RATIO Range: Channel A: 0 to 20 MHz Channel B: 0 to 10 MHz		<input type="checkbox"/> 20 MHz <input type="checkbox"/> 10 MHz	
TIME BASE 1. Stability: Aging Rate: 3 parts in 10^7 /month Temperature: ± 2.5 parts in 10^6 , 0 to +50°C Line Voltage: ± 1 part in 10^7 for a 10% line voltage change 2. Oscillator OUTPUT: 10 MHz, 1 V p-p 3. EXTERNAL INPUT: 1 V rms at 1, 2.5, 5, or 10 MHz		<input type="checkbox"/> 3 parts in 10^7 /month <input type="checkbox"/> ± 2.5 parts in 10^6 <input type="checkbox"/> ± 1 part in 10^7 <input type="checkbox"/> 10 MHz, 1 V p-p <input type="checkbox"/> 1 V rms	
DIGITAL OUTPUT Code: 8-4-2-1		<input type="checkbox"/> Digital Recorder displays all digits in each column	

PERFORMANCE CHECK TEST CARD

<p>Hewlett-Packard Model 5325B Universal Counter</p> <p>Serial No. _____</p>	<p>Tests Performed by _____</p> <p>Date _____</p>
DESCRIPTION	CHECK
<p>START</p> <p>Range: 0 to 10 MHz</p>	<div style="display: flex; align-items: center;"> <input style="width: 50px; height: 20px; margin-right: 10px;" type="text"/> 10 Hz to 10 MHz </div>
<p>FREQUENCY</p> <p>1. Range: 0 to 20 MHz d. FAST/NORM/HOLD e. MARKER A and B f. GATE output</p> <p>2. Sensitivity: 0.1 V rms (.28 V p-p)</p>	<div style="display: flex; align-items: center; margin-bottom: 10px;"> <input style="width: 50px; height: 20px; margin-right: 10px;" type="text"/> 10 Hz to 20 MHz </div> <div style="display: flex; align-items: center;"> <input style="width: 50px; height: 20px; margin-right: 10px;" type="text"/> 0.1 V rms </div>
<p>TIME INTERVAL</p> <p>Range: .1 μs to 10^8 seconds</p>	<div style="display: flex; align-items: center;"> <input style="width: 50px; height: 20px; margin-right: 10px;" type="text"/> .1 μs to 10^2 seconds </div>
<p>PERIOD</p> <p>Range: 0 to 10 MHz</p>	<div style="display: flex; align-items: center;"> <input style="width: 50px; height: 20px; margin-right: 10px;" type="text"/> 10 Hz to 5 MHz </div>
<p>PERIOD AVERAGE</p> <p>Range: 0 to 10 MHz</p>	<div style="display: flex; align-items: center;"> <input style="width: 50px; height: 20px; margin-right: 10px;" type="text"/> 10 Hz to 5 MHz </div>
<p>RATIO</p> <p>Range: Channel A: 0 to 20 MHz Channel B: 0 to 10 MHz</p>	<div style="display: flex; align-items: center; margin-bottom: 10px;"> <input style="width: 50px; height: 20px; margin-right: 10px;" type="text"/> 20 MHz </div> <div style="display: flex; align-items: center;"> <input style="width: 50px; height: 20px; margin-right: 10px;" type="text"/> 10 MHz </div>
<p>TIME BASE</p> <p>1. Stability: Aging Rate: 3 parts in 10^7/month Temperature: ± 2.5 parts in 10^6, 0 to +50°C Line Voltage: ± 1 part in 10^7 for a 10% line voltage change</p> <p>2. Oscillator OUTPUT: 10 MHz, 1 V p-p</p> <p>3. EXTERNAL INPUT: 1 V rms at 1, 2.5, 5, or 10 MHz</p>	<div style="display: flex; align-items: center; margin-bottom: 10px;"> <input style="width: 50px; height: 20px; margin-right: 10px;" type="text"/> 3 parts in 10^7/month </div> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <input style="width: 50px; height: 20px; margin-right: 10px;" type="text"/> ± 2.5 parts in 10^6 </div> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <input style="width: 50px; height: 20px; margin-right: 10px;" type="text"/> ± 1 part in 10^7 </div> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <input style="width: 50px; height: 20px; margin-right: 10px;" type="text"/> 10 MHz, 1 V p-p </div> <div style="display: flex; align-items: center;"> <input style="width: 50px; height: 20px; margin-right: 10px;" type="text"/> 1 V rms </div>
<p>DIGITAL OUTPUT</p> <p>Code: 8-4-2-1</p>	<div style="display: flex; align-items: center;"> <input style="width: 50px; height: 20px; margin-right: 10px;" type="text"/> Digital Recorder displays all digits in each column </div>

PARTS LIST

6-1. INTRODUCTION

6-3. Miscellaneous parts are listed at the end of Table 6-1.

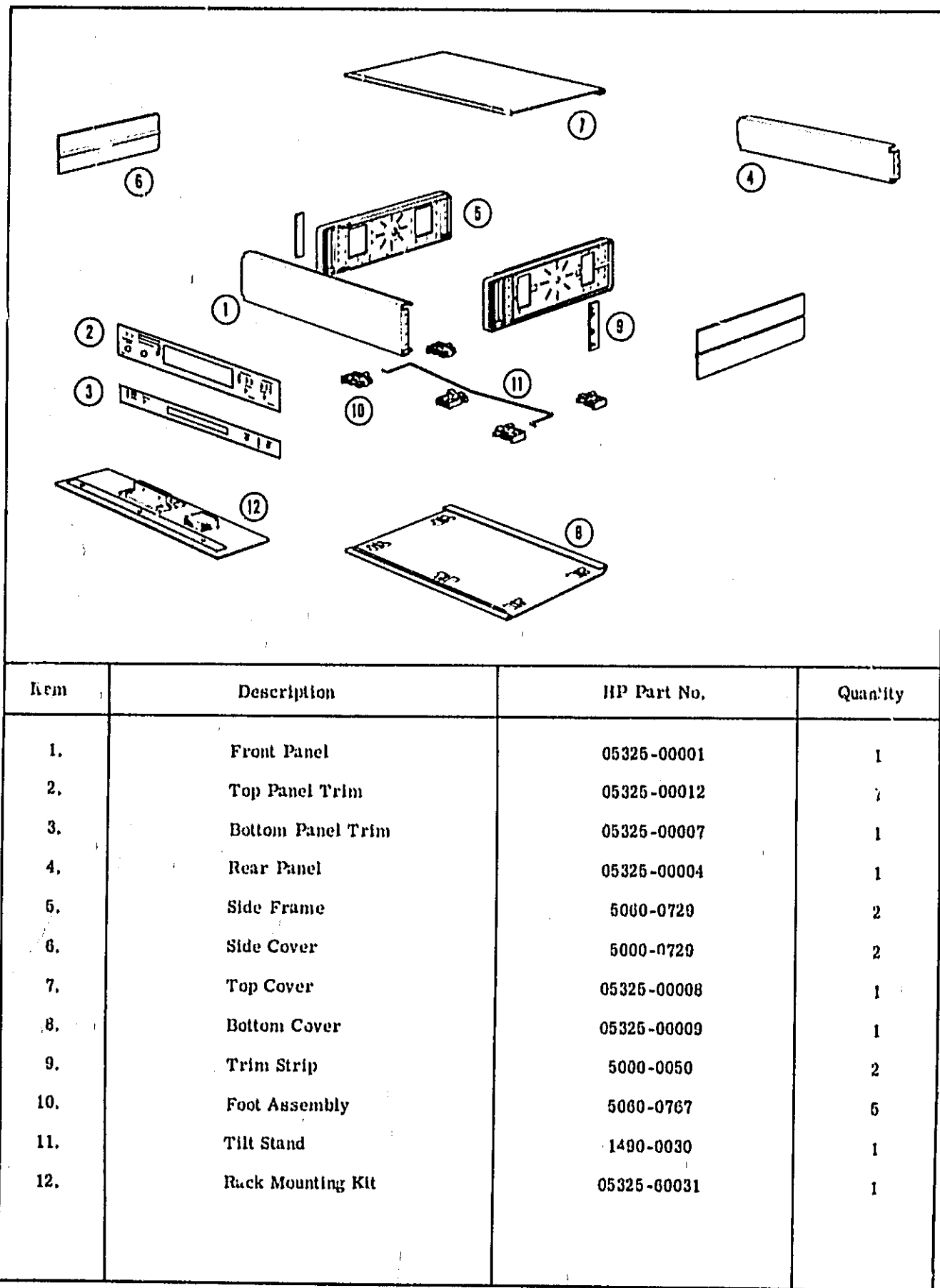
0-5. To obtain replacement parts, address order or inquiry to your local Hewlett-Packard Sales and Service office (see lists at rear of this manual for addresses). Identify parts by their Hewlett-Packard part numbers.

- a. Description of part (see abbreviations below).
- b. Typical manufacturer of the part in a five-digit code; see list of manufacturers in Table G-3.
- c. Manufacturer's part number.
- d. Total quantity used in the instrument (TQ column).

- a. Instrument model number,
- b. Instrument serial number,
- c. Description of the part,
- d. Function and location of the part.

6-1

Figure 6-1. Cabinet Parts



Ref. or Designation	Part No.	Description #	Note
A1	05312-2724C	INSTR ATTENUATION ASSY	
	05312-2724D	BOARD/BLANK PC	
A1E1	018F-C10F	CEP3D MV 0.033 UF 5R	
A1E2	012F-C10C	CEP3D MV 0.033 UF 5R	
A1E3	015C-CE1E	CEP3D CIR 20 PF 10R 300VDCW	
A1E4	018G-1402	CEP3D F11D-1100 350 PF 10R 300VDCW	
A1E5	015C-CE1E	CEP3D CIR 20 PF 10R 300VDCW	
A1E6	018C-1423	CEP3D F11D-1100 350 PF 10R 300VDCW	
A1E7	C160 2056	CEP3D CIR 0.5C1 UF 180-20R 100VDCW	
A1E8	C160 2056	CEP3D CIR 0.5C1 UF 180-20R 100VDCW	
A1P1	C683-1C1E	CEP3D CUMP 1 MEGOHM 5R 1/4W	
A1R1	C683-1C4E	CEP3D CUMP 100K OHMS 5R 1/4W	
A1R2	C683-1C1E	CEP3D CUMP 10K OHM 5R 1/4W	
A1R3	C683-1C1E	CEP3D CUMP 1 MEGOHM 5R 1/4W	
A1R4	C683-1C4E	CEP3D CUMP 100K OHMS 5R 1/4W	
A1R5	C683-1C1E	CEP3D CUMP 10K OHM 5R 1/4W	
A1S1	3101-1066	SWITCH/BLDR DPDT 0.5A 125V AC/DC	
A1S2	3101-1066	SWITCH/BLDR DPDT 0.5A 125V AC/DC	
A1S3	3101-1066	SWITCH/BLDR DPDT 0.5A 125V AC/DC	
A1S4	3101-1066	SWITCH/BLDR DPDT 0.5A 125V AC/DC	
A1S5	3101-1066	SWITCH/BLDR DPDT 0.5A 125V AC/DC	
A1S6	3101-1066	SWITCH/BLDR DPDT 0.5A 125V AC/DC	
A1S7	3101-1066	SWITCH/BLDR DPDT 0.5A 125V AC/DC	
A2	05320-27C1E	BOARD ASSY/AMPLIFIER	
	05320-27C1E	BOARD/BLANK PC	
A2E1	018D-C21C	CEP3D ELECT 3.3 UF 20R 150VDC	
A2E2	018F-C21C	CEP3D ELECT 3.3 UF 20R 150VDC	
A2E3		MKT ASSIGNED	
A2E4	018C-1141	CEP3D ELECT 0.1 UF 10R 150VDC	
A2E5	018D-0157	CEP3D MICA 80 PF 6K 300VDCW	
A2E6	018E-0157	CEP3D MICA 80 PF 6K 300VDCW	
A2E7	018C-0157	CEP3D CIR 0.2 1025 PF 600VDCW	
A2E8	018C-0157	CEP3D ELECT 3.3 UF 20R 150VDCW	
A2E9	018C-0157	CEP3D CIR 0.2 1025 PF 600VDCW	
A2E10	018C-0157	CEP3D CIR 0.2 1025 PF 600VDCW	
A2E11	018C-0157	CEP3D CIR 0.2 1025 PF 600VDCW	
A2E12	018F-0157	CEP3D ELECT 3.3 UF 20R 150VDCW	
A2E13	018C-0157	CEP3D MICA 200 PF 5R 300VDCW	
A2E14	018C-0157	CEP3D MICA 200 PF 5R 300VDCW	
A2E15	018C-0210	CEP3D ELECT 3.3 UF 20R 150VDCW	
A2E16	018C-2748	CEP3D CIR 4.3 1025 PF 600VDCW	

See introduction to this section for ordering information

Reference Designation	Part No.	Description #	Note
A2E17	015C-CFA3	LEAD LIN 3000 IN 100-200 SCREEN	
A2E18	0160-CF77	CARD MICA 16 FT 100 FT DIVISION	
A2E19	016C-CFA3	LEAD LIN 300-0.001 FT 100V/IN	
A2E20	015C-CFA3	LEAD LIN 1000 FT 100V/IN	
A2E21	016C-CFA3	CARD MICA 30 FT 50 DIVISION	
A2E22		NOT ASSIGNED	
A2E23	1501-C176	0101 1501 LEAD 15V	
A2E24	1501-C177	0101 1501 LEAD 15V	
A2E25		NOT ASSIGNED	
A2E26	1001-0130	0101 1001 LEAD 100V	
A2E27	1001-0130	0101 1001 LEAD 100V	
A2E28	1510-CF77	0101 GERMANIUM 15V	
A2E29	1510-CF77	0101 GERMANIUM 15V	
A2E30	1010-0122	0101 GERMANIUM 10V	
A2E31	1001-0161	0101 1001 LEAD 10-100V/IN 100V/IN	
A2E32	1501-CFA3	0101 1501 LEAD 100V 100V	
A2E33	1501-CFA3	0101 1501 LEAD 100V 100V	
A2E34	1501-CFA3	0101 1501 LEAD 100V 100V	
A2E35	1555-CF77	0101 1555	
A2E36	1063-0116	0101 1063	
A2E37	1063-0116	0101 1063	
A2E38	1063-0116	0101 1063	
A2E39	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E40	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E41	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E42	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E43	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E44	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E45	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E46	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E47	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E48	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E49	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E50	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E51	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E52	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E53	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E54	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E55	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E56	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E57	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E58	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E59	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E60	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E61	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E62	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E63	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E64	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E65	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E66	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E67	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E68	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E69	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E70	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E71	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E72	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E73	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E74	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E75	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E76	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E77	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E78	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E79	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E80	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E81	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E82	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E83	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E84	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E85	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E86	1054-CF77	0101 1054 100V/IN 100V/IN	
A2E87	1054-CF77	0101 1054 100V/IN 100V/IN	

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Table 6-1. Reference Designation Index

Model 5325B

Reference Designator	HP Part No.	Description #
A7R6	0683 2572	R F X D COMP 1500 OHM 1/4W
A7R7	0683 1536	R F X D COMP 15K OHM 1/4W
A7R8	0683 1076	R F X D COMP 1000 OHM 1/4W
A7R9	0683 2006	R F X D COMP 20 OHM 1/4W
A7R10	0683 4316	R F X D COMP 450 OHM 1/4W
A7R11	0683 6216	R F X D COMP 620 OHM 1/4W
A7R12	0683 4716	R F X D COMP 470 OHM 1/4W
A7R13	0683 6106	R F X D COMP 61 OHM 1/4W
A7U1	1820 0142	CIRCUIT INTEGRATED
A7U2	1820 0264	CIRCUIT INTEGRATED
A7Y1	0410 0406	CRYSTAL
A8	06376 00047	ASSY. COUNTER BOARD
	06376 20047	BOARD BLANK PC
ABC1	0180 0118	C F X D ELECT 8 RUF 10% 36VDCW
ABC2	0180 0201	C F X D ELECT 10UF 10% 36VDCW
ABC3	0180 2190	C F X D MICA 30 PF 5% 300VDCW
ABC4	0180 0291	C F X D ELECT 10UF 10% 36VDCW
ABC5	0140 0176	C F X D MICA 100 PF 2% 300VDCW

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Reference Designator	HP Part No.	Description #
A8R17	0683 1626	R F X D COMP 1600 OHM 5% 1/4W
A8	06376 60012	ASSY CRYSTAL OVEN 10MHZ
	7100 0211	CAN SQUARE 1-1/2" X 2 3/16"
	06376 20016	BOARD BLANK PC
	7100 0203	COVER SQUARE 1-15/32 X 3/16"
A8RT1	0410 0181	COMPONENT OVEN
A8Y1	0410 0176	CRYSTAL QUARTZ 10 MHZ
A7	06376 60060	ASSY. OSCILLATOR MULTI BOARD
	06376 20060	BOARD BLANK PC
A7C1	0121 0060	C VAR CER DISK 2 R PF
A7C2	0160 2262	C F X D CER 18 PF 5% 500VDCW
A7C3	0160 3080	C F X D CER 1 UF 20% 25VDCW
A7C4	0160 0181	C F X D MY 01 UF 10% 200VDCW
A7C5	0180 0187	C F X D TANT 22 PF 10% 20VDCW
A7C6	0160 0076	C F X D CER 0047 UF +100-20% 500VDCW
A7C7	0160 2306	C F X D MICA 37PF 5% 300VDCW
A7C8	0160 0076	C F X D CER 0047 UF +100-20% 500VDCW
A7CR1	1810 0034	DIODE GER 100 MA
A7CR2	1802 3130	DIODE BRKDN 825V
A7L1	B100-2276	COIL 100 UH
A7Q1	1864 0000	TRANSISTOR 2N700
A7Q2	1860 0168	TRANSISTOR 2N2636
A7Q3	1864 0000	TRANSISTOR 2N708
A7R1	0798 4037	R F X D FLN 46.4 OHM 1/8W
A7R2	0683 1026	R F X D COMP 1000 OHM 1/4W
A7R3	0683 1026	R F X D COMP 1000 OHM 1/4W
A7R4	0683 1036	R F X D COMP 10K OHM 1/4W
A7R5	0683 1026	R F X D COMP 1000 OHM 1/4W

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Section VI

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Table 6-1. Reference Designation Index

Model 5325B

Reference Designation	Qty Part No.	Description #	Note
ARR11	CAR1-2122	REFID COMP 27K OHM 5% 1/4W	
ARR12	CAR1-2122	REFID COMP 27K OHM 5% 1/4W	
ARR13	CAR1-2122	REFID COMP 27K OHM 5% 1/4W	
ARR14	CAR1-2122	REFID COMP 27K OHM 5% 1/4W	
ARR15	CAR1-2122	REFID COMP 27K OHM 5% 1/4W	
ARR16	CAR1-1C22	REFID COMP 10K OHM 5% 1/4W	
ARR17	CAR1-1C22	REFID COMP 10K OHM 5% 1/4W	
ARR18	CAR1-2122	REFID COMP 27K OHM 5% 1/4W	
ARR19	CAR1-1022	REFID COMP 10K OHM 5% 1/4W	
ARR20	CAR1-2122	REFID COMP 27K OHM 5% 1/4W	
ARR21	CAR1-1C22	REFID COMP 10K OHM 5% 1/4W	
ARR22	CAR1-2012	REFID COMP 20K OHM 5% 1/4W	
ARR23	CAR1-6122	REFID COMP 68K OHM 5% 1/4W	
ARR24	CAR1-2C22	REFID COMP 10K OHM 5% 1/4W	
ARR25	CAR1-2022	REFID COMP 200K OHM 5% 1/4W	
ARR26	CAR1-1C22	REFID COMP 10K OHM 5% 1/4W	
ARR27	CAR1-2122	REFID COMP 27K OHM 5% 1/4W	
ARR28	CAR1-2122	REFID COMP 27K OHM 5% 1/4W	
ARR29	CAR1-2122	REFID COMP 27K OHM 5% 1/4W	
ARR30	CAR1-2122	REFID COMP 27K OHM 5% 1/4W	
ARR31	CAR1-1C22	REFID COMP 10K OHM 5% 1/4W	
ARR32	CAR1-1C22	REFID COMP 10K OHM 5% 1/4W	
ARR33	CAR1-2122	REFID COMP 27K OHM 5% 1/4W	
ARR34	CAR1-1C22	REFID COMP 10K OHM 5% 1/4W	
ARR35	CAR1-2022	REFID COMP 200K OHM 5% 1/4W	
ARR36	CAR1-2122	REFID COMP 27K OHM 5% 1/4W	
ARR37	CAR1-2122	REFID COMP 27K OHM 5% 1/4W	
ARR38	CAR1-2122	REFID COMP 27K OHM 5% 1/4W	
ARR39	CAR1-2122	REFID COMP 27K OHM 5% 1/4W	
ARR40	CAR1-2022	REFID COMP 200K OHM 5% 1/4W	
ARR41	0583-2025	REFID COMP 20K OHM 5% 1/4W	
ARR42	CAR1-2122	REFID COMP 27K OHM 5% 1/4W	
ARR43	0583-1225	REFID COMP 12K OHM 5% 1/4W	
ARR44	0583-1225	REFID COMP 12K OHM 5% 1/4W	
ARR45	CAR1-2122	REFID COMP 27K OHM 5% 1/4W	
ARR46	2083-4315	REFID COMP 470 OHM 5% 1/4W	
ARR47	CAR1-1022	REFID COMP 10K OHM 5% 1/4W	
ARR48	CAR1-1C22	REFID COMP 10K OHM 5% 1/4W	
ARR49	CAR1-1C22	REFID COMP 10K OHM 5% 1/4W	
ARR50	CAR1-1C22	REFID COMP 10K OHM 5% 1/4W	
ARR51	CAR1-1522	REFID COMP 150K OHM 5% 1/4W	
ARR52	CAR1-1C22	REFID COMP 10K OHM 5% 1/4W	
ARR53	CAR1-2122	REFID COMP 27K OHM 5% 1/4W	
ARR54	CAR1-4315	REFID COMP 470 OHM 5% 1/4W	
ARR55	CAR1-2122	REFID COMP 27K OHM 5% 1/4W	
ARR56	0583-4325	REFID COMP 470 OHM 5% 1/4W	
ARR57	0583-6115	REFID COMP 680 OHM 5% 1/4W	
ARR58	0583-4325	REFID COMP 470 OHM 5% 1/4W	
ARR59	0583-4325	REFID COMP 470 OHM 5% 1/4W	
ARR60	0583-4315	REFID COMP 470 OHM 5% 1/4W	

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Reference Designation	Qty Part No.	Description #	Note
AR	0512-2022	ASSOCIATED BOARD	
	0512-2022	BOARD/BLANK PC	
AS011	157C-CC1	TURFILLICTRON 10-DIGIT INDICATION	
AS012	157C-CC2	TURFILLICTRON 10-DIGIT INDICATION	
AS013	157C-CC3	TURFILLICTRON 10-DIGIT INDICATION	
AS014	157C-CC4	TURFILLICTRON 10-DIGIT INDICATION	
AS015	157C-CC5	TURFILLICTRON 10-DIGIT INDICATION	
AS016	157C-CC6	TURFILLICTRON 10-DIGIT INDICATION	
AS017	157C-CC7	TURFILLICTRON 10-DIGIT INDICATION	
AS018	157C-CC8	TURFILLICTRON 10-DIGIT INDICATION	
AS019	157C-CC9	TURFILLICTRON 10-DIGIT INDICATION	
AS020	157C-CC10	TURFILLICTRON 10-DIGIT INDICATION	
AS021	157C-CC11	TURFILLICTRON 10-DIGIT INDICATION	
AS022	157C-CC12	TURFILLICTRON 10-DIGIT INDICATION	
AS023	157C-CC13	TURFILLICTRON 10-DIGIT INDICATION	
AS024	157C-CC14	TURFILLICTRON 10-DIGIT INDICATION	
AS025	157C-CC15	TURFILLICTRON 10-DIGIT INDICATION	
AS026	157C-CC16	TURFILLICTRON 10-DIGIT INDICATION	
AS027	157C-CC17	TURFILLICTRON 10-DIGIT INDICATION	
AS028	157C-CC18	TURFILLICTRON 10-DIGIT INDICATION	
AS029	157C-CC19	TURFILLICTRON 10-DIGIT INDICATION	
AS030	157C-CC20	TURFILLICTRON 10-DIGIT INDICATION	
AS031	157C-CC21	TURFILLICTRON 10-DIGIT INDICATION	
AS032	157C-CC22	TURFILLICTRON 10-DIGIT INDICATION	
AS033	157C-CC23	TURFILLICTRON 10-DIGIT INDICATION	
AS034	157C-CC24	TURFILLICTRON 10-DIGIT INDICATION	
AS035	157C-CC25	TURFILLICTRON 10-DIGIT INDICATION	
AS036	157C-CC26	TURFILLICTRON 10-DIGIT INDICATION	
AS037	157C-CC27	TURFILLICTRON 10-DIGIT INDICATION	
AS038	157C-CC28	TURFILLICTRON 10-DIGIT INDICATION	
AS039	157C-CC29	TURFILLICTRON 10-DIGIT INDICATION	
AS040	157C-CC30	TURFILLICTRON 10-DIGIT INDICATION	
AS041	157C-CC31	TURFILLICTRON 10-DIGIT INDICATION	
AS042	157C-CC32	TURFILLICTRON 10-DIGIT INDICATION	
AS043	157C-CC33	TURFILLICTRON 10-DIGIT INDICATION	
AS044	157C-CC34	TURFILLICTRON 10-DIGIT INDICATION	
AS045	157C-CC35	TURFILLICTRON 10-DIGIT INDICATION	
AS046	157C-CC36	TURFILLICTRON 10-DIGIT INDICATION	
AS047	157C-CC37	TURFILLICTRON 10-DIGIT INDICATION	
AS048	157C-CC38	TURFILLICTRON 10-DIGIT INDICATION	
AS049	157C-CC39	TURFILLICTRON 10-DIGIT INDICATION	
AS050	157C-CC40	TURFILLICTRON 10-DIGIT INDICATION	
AS051	157C-CC41	TURFILLICTRON 10-DIGIT INDICATION	
AS052	157C-CC42	TURFILLICTRON 10-DIGIT INDICATION	
AS053	157C-CC43	TURFILLICTRON 10-DIGIT INDICATION	
AS054	157C-CC44	TURFILLICTRON 10-DIGIT INDICATION	
AS055	157C-CC45	TURFILLICTRON 10-DIGIT INDICATION	
AS056	157C-CC46	TURFILLICTRON 10-DIGIT INDICATION	
AS057	157C-CC47	TURFILLICTRON 10-DIGIT INDICATION	
AS058	157C-CC48	TURFILLICTRON 10-DIGIT INDICATION	
AS059	157C-CC49	TURFILLICTRON 10-DIGIT INDICATION	
AS060	157C-CC50	TURFILLICTRON 10-DIGIT INDICATION	
AS061	157C-CC51	TURFILLICTRON 10-DIGIT INDICATION	
AS062	157C-CC52	TURFILLICTRON 10-DIGIT INDICATION	
AS063	157C-CC53	TURFILLICTRON 10-DIGIT INDICATION	
AS064	157C-CC54	TURFILLICTRON 10-DIGIT INDICATION	
AS065	157C-CC55	TURFILLICTRON 10-DIGIT INDICATION	
AS066	157C-CC56	TURFILLICTRON 10-DIGIT INDICATION	
AS067	157C-CC57	TURFILLICTRON 10-DIGIT INDICATION	
AS068	157C-CC58	TURFILLICTRON 10-DIGIT INDICATION	
AS069	157C-CC59	TURFILLICTRON 10-DIGIT INDICATION	
AS070	157C-CC60	TURFILLICTRON 10-DIGIT INDICATION	
AS071	157C-CC61	TURFILLICTRON 10-DIGIT INDICATION	
AS072	157C-CC62	TURFILLICTRON 10-DIGIT INDICATION	
AS073	157C-CC63	TURFILLICTRON 10-DIGIT INDICATION	
AS074	157C-CC64	TURFILLICTRON 10-DIGIT INDICATION	
AS075	157C-CC65	TURFILLICTRON 10-DIGIT INDICATION	
AS076	157C-CC66	TURFILLICTRON 10-DIGIT INDICATION	
AS077	157C-CC67	TURFILLICTRON 10-DIGIT INDICATION	
AS078	157C-CC68	TURFILLICTRON 10-DIGIT INDICATION	
AS079	157C-CC69	TURFILLICTRON 10-DIGIT INDICATION	
AS080	157C-CC70	TURFILLICTRON 10-DIGIT INDICATION	
AS081	157C-CC71	TURFILLICTRON 10-DIGIT INDICATION	
AS082	157C-CC72	TURFILLICTRON 10-DIGIT INDICATION	
AS083	157C-CC73	TURFILLICTRON 10-DIGIT INDICATION	
AS084	157C-CC74	TURFILLICTRON 10-DIGIT INDICATION	
AS085	157C-CC75	TURFILLICTRON 10-DIGIT INDICATION	
AS086	157C-CC76	TURFILLICTRON 10-DIGIT INDICATION	
AS087	157C-CC77	TURFILLICTRON 10-DIGIT INDICATION	
AS088	157C-CC78	TURFILLICTRON 10-DIGIT INDICATION	
AS089	157C-CC79	TURFILLICTRON 10-DIGIT INDICATION	
AS090	157C-CC80	TURFILLICTRON 10-DIGIT INDICATION	
AS091	157C-CC81	TURFILLICTRON 10-DIGIT INDICATION	
AS092	157C-CC82	TURFILLICTRON 10-DIGIT INDICATION	
AS093	157C-CC83	TURFILLICTRON 10-DIGIT INDICATION	
AS094	157C-CC84	TURFILLICTRON 10-DIGIT INDICATION	
AS095	157C-CC85	TURFILLICTRON 10-DIGIT INDICATION	
AS096	157C-CC86	TURFILLICTRON 10-DIGIT INDICATION	
AS097	157C-CC87	TURFILLICTRON 10-DIGIT INDICATION	
AS098	157C-CC88	TURFILLICTRON 10-DIGIT INDICATION	
AS099	157C-CC89	TURFILLICTRON 10-DIGIT INDICATION	
AS100	157C-CC90	TURFILLICTRON 10-DIGIT INDICATION	

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Section VI
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Reference Designation	Part No.	Description #	Note
55	5000-2417	LABELPUSHBUTTON(STOP)	
56		NSP PART OF R2	
57		NSP PART OF R4	
58	3101-1603	SWITCHSLIDE DPDT 0.5A 125V AC/DC	
59	3101-1603	SWITCHSLIDE DPDT 0.5A 125V AC/DC	
610	3101-1234	SWITCHSLIDE DPDT	
61	9100-2237	TRANSFORMERPOWER	
61	05125-2237	SWITCH ASSYTIME BASE(PART OF 519,701)	
62	05125-2237	CABLE ASSYVIBRA	
63	05125-2237	CABLE ASSYPOWER SUPPLY	
64	05125-2237	CABLE ASSYPOWER SUPPLY	
65	8120-1237	CABLE ASSYPOWER CORD	
66		NOT ASSIGNED	
67	05125-2237	CABLE ASSYVIBRA POWER	
68	05125-2237	CABLE ASSYVIBRA POWER	
69	05125-2237	CABLE ASSYVIBRA	
70	05125-2237	CABLE ASSYVIBRA	
71	05125-2237	ASSYPOWER SUPPLY NO. 2	
72	05125-2237	CABLE ASSYVIBRA	
73	05125-2237	CABLE ASSYVIBRA	
74	05125-2237	CABLE ASSYVIBRA	
75	05125-2237	CABLE ASSYFUNCTION SWITCH	
76	05125-2237	CABLE ASSYAMPLIFIER INPUT	
77	05125-2237	CABLE ASSYAMPLIFIER INPUT	
78	05125-2237	CABLE ASSYOSCILLATOR INPUT	
79	05125-2237	CABLE ASSYDECIMAL POINT	
80	05125-2237	CABLE ASSYFUNCTION SELECTOR	
81		NOT ASSIGNED	
82	1251-0100	CONNECTOR15 PIN	
83	1251-0100	CONNECTOR15 PIN	
84	1251-0135	CONNECTOR15 CONTACT	
85	1251-0100	CONNECTOR15 PIN	
86		NOT ASSIGNED	
87	1251-0100	CONNECTOR15 PIN	
88		NOT ASSIGNED	
89		NOT ASSIGNED	
90	1251-0100	CONNECTOR15 PIN	
91	1251-0100	CONNECTOR15 PIN	
92	1400-2237	PUSINGCLEREXTRACTION POST TYPE	
93	1251-2237	CONNECTORPOWER 3 PIN PAIR	
94		MISCELLANEOUS	
95		SUPPORTINGJARDIAL, 421	
96		INSULATOR	
97		ACCESSORY CABLE INCLUDES:	
98			
99	10513A	DIGITAL RECORDINGINTERCONNECTING CABLE	
100	1251-1111	REPAIRING FOR CRT BD SECRETS	
101	1251-2237	CONNECTOR150 CONTACT H & P	
102	0400-0007	CONNECTORFOR 1/2" DIA HOLE	
103	1251-0135	CONNECTOR 1/2" DIA CONTACTS	

See Introduction to this section for ordering information

Reference Designation	Part No.	Description #	Note
11	2410-0201	FULLCAREWEDGE 0.25 AMP 510W BLEM 1230V OPERATIONS	
12	1250-2237	CONNECTOR150	
13	1250-2237	CONNECTOR150	
14	1250-2237	CONNECTOR150	
15	1250-2237	CONNECTOR150	
16	1250-2237	CONNECTOR150	
17	1250-2237	CONNECTOR150	
18	1250-2237	CONNECTOR150	
19	0140-0115	COIL/CHOK 22.0 OHM 10T	
20	0140-0115	COIL/CHOK 22.0 OHM 10T	
21	0140-0115	COIL/CHOK 22.0 OHM 10T	
22	0140-0115	COIL/CHOK 22.0 OHM 10T	
23	0140-0115	COIL/CHOK 22.0 OHM 10T	
24	0140-0115	COIL/CHOK 22.0 OHM 10T	
25	0140-0115	COIL/CHOK 22.0 OHM 10T	
26	0140-0115	COIL/CHOK 22.0 OHM 10T	
27	05125-2237	INTEGRATEDCUT	
28	05125-2237	INTEGRATEDCUT	
29	05125-2237	INTEGRATEDCUT	
30	05125-2237	INTEGRATEDCUT	
31	05125-2237	INTEGRATEDCUT	
32	05125-2237	INTEGRATEDCUT	
33	05125-2237	INTEGRATEDCUT	
34	05125-2237	INTEGRATEDCUT	
35	05125-2237	INTEGRATEDCUT	
36	05125-2237	INTEGRATEDCUT	
37	05125-2237	INTEGRATEDCUT	
38	05125-2237	INTEGRATEDCUT	
39	05125-2237	INTEGRATEDCUT	
40	05125-2237	INTEGRATEDCUT	
41	10513A	DIGITAL RECORDINGINTERCONNECTING CABLE	
42	1251-0100	CONNECTOR15 PIN	
43	1251-0100	CONNECTOR15 PIN	
44	1251-0135	CONNECTOR15 CONTACT	
45	1251-0100	CONNECTOR15 PIN	
46		NOT ASSIGNED	
47	1251-0100	CONNECTOR15 PIN	
48		NOT ASSIGNED	
49		NOT ASSIGNED	
50	1251-0100	CONNECTOR15 PIN	
51	1251-0100	CONNECTOR15 PIN	
52	1400-2237	PUSINGCLEREXTRACTION POST TYPE	
53	1251-2237	CONNECTORPOWER 3 PIN PAIR	
54		MISCELLANEOUS	
55		SUPPORTINGJARDIAL, 421	
56		INSULATOR	
57		ACCESSORY CABLE INCLUDES:	
58			
59	10513A	DIGITAL RECORDINGINTERCONNECTING CABLE	
60	1251-1111	REPAIRING FOR CRT BD SECRETS	
61	1251-2237	CONNECTOR150 CONTACT H & P	
62	0400-0007	CONNECTORFOR 1/2" DIA HOLE	
63	1251-0135	CONNECTOR 1/2" DIA CONTACTS	

See Introduction to this section for ordering information

Reference Designation	Hy Part No.	Description #	Note
22	224E-CEC2	MUTHER FOR 84 HDW	
22	220C-CE51	SCREW SST PAN HD 4-40 THD	
22	16512-AC71	CABLE CONNECTOR	
22	8120-1011	CABLE 136 CONDUCTOR	
	06323 60031	KIT RACK MOUNTING, INCLUDES:	
	2210 0012	SCREW MACH 8-32 (3)	
	2610 0047	SCREW MACH 8-32 (4)	
	6020 0706	BRACKET LH	
	6020 0707	BRACKET RH	
	06246 0022	BOARD ASSY EXTENDER	
	06325 90006	LABEL	
	06326 40002	STRIP FILLER	

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Part No.	Description	Mfr.	Mfr. Part No.	Qty
0658-5174	RESISTOR 200 OHM 5% 1/8W	24480	0658-5174	2
0658-5180	RESISTOR 1K OHM 5% 1/8W	24480	0658-5180	2
0658-5183	RESISTOR 4.7K OHM 5% 1/8W	24480	0658-5183	1
0658-5185	RESISTOR 15K OHM 5% 1/8W	24480	0658-5185	1
0658-5585	RESISTOR CARBON 1/2K OHM 5% 1/8W	24480	0658-5585	4
0658-5586	RESISTOR 2.4K OHM 5% 1/8W	24480	0658-5586	1
0658-5587	RESISTOR CARBON 1/2K OHM 5% 1/8W	24480	0658-5587	1
0658-5589	RESISTOR 560 OHM 5% 1/8W	24480	0658-5589	1
0658-5597	RESISTOR 12K OHM 5% 1/8W	24480	0658-5597	1
0658-6000	RESISTOR 2.7K OHM 5% 1/8W	24480	0658-6000	2
0658-6001	RESISTOR 10K OHM 5% 1/8W	24480	0658-6001	1
0658-6123	RESISTOR 20K OHM 5% 1/8W	24480	0658-6123	2
1200-0166	SUBSTITUTION IN CONTACT	F1574	SK 196	1
1250-0083	CONNECTOR 1/2" PIN	24480	1250-0083	5
1250-0118	CONNECTOR 1/2" PIN	24480	24480	2
1251-0086	CONNECTOR 1/2" CONTACT R & P	24480	1251-0086	1
1251-0087	CONNECTOR 1/2" 50-PIN MINUT	24480	1251-0087	1
1251-0148	CONNECTOR 1/2" 3 PIN MALE	01810	1085-1	1
1251-0159	CONNECTOR 1/2" CONTACT	24480	1251-0159	1
1251-0160	CONNECTOR 1/2" PIN	24480	1251-0160	4
1251-0334	CONNECTOR 1/2" CONTACTS	C1333	251-18-10-241	1
1251-1115	REPLACEMENT FOR CONTACT SOCKETS	F1574	456-99-99-193	1
1251-2225	CONNECTOR 1/2" CONTACTS	C2680	275-2221-105	1
1400-0094	PLATE IDENTIFICATION POST TYPE	F0215	342015	1
1400-0449	BRACKET RIGHT ANGLE	24480	1400-0449	1
1450-0049	LAMPION INDICATOR 115V	CF317	050-C/NE21	1
1870-0054	IC 1/2" GUARD 2-INPUT NAND GATE	C1295	5M312	7
1870-0055	INTEGRATED CIRCUIT TTL	C1295	5M3170N	1
1870-0068	INTEGRATED CIRCUIT TTL	56289	UM7410A	2
1870-0065	INTEGRATED CIRCUIT TTL	56289	UM742CA	7
1870-0074	INTEGRATED CIRCUIT WIDE, 2-INPUT INVERT	C1295	5M354N	1
1870-0076	IC 1/2" GUARD MASTER/SLAVE FF	C1295	5M355	1
1870-0092	INTEGRATED CIRCUIT DRIVER	24480	1870-0092	1
1870-0116	IC 1/2" 8-INPUT GATED ORS	24480	1870-0116	1
1870-0117	INTEGRATED CIRCUIT	24480	1870-0117	1
1870-0119	INTEGRATED CIRCUIT DECADE DIVIDER	24480	1870-0119	6
1870-0154	INTEGRATED CIRCUIT DECADE DIVIDER	24480	1870-0154	1
1870-0307	IC 1/2" 4-INPUT INVERT	C1295	5M354N	2
1870-0380	INTEGRATED CIRCUIT TTL	24480	1870-0380	1
1870-0670	IC 1/2" 16-INPUT	24480	1870-0670	1
1870-0676	IC 1/2" 16-INPUT	24480	1870-0676	1
1870-0679	IC 1/2" 16-INPUT	24480	1870-0679	1
1870-0680	IC 1/2" 16-INPUT	24480	1870-0680	1
1870-0681	IC 1/2" 16-INPUT	24480	1870-0681	1
1870-0682	IC 1/2" 16-INPUT	24480	1870-0682	1
1870-0683	IC 1/2" 16-INPUT	24480	1870-0683	1
1870-0684	IC 1/2" 16-INPUT	24480	1870-0684	1
1870-0685	IC 1/2" 16-INPUT	24480	1870-0685	1
1870-0686	IC 1/2" 16-INPUT	24480	1870-0686	1
1870-0687	IC 1/2" 16-INPUT	24480	1870-0687	1
1870-0688	IC 1/2" 16-INPUT	24480	1870-0688	1
1870-0689	IC 1/2" 16-INPUT	24480	1870-0689	1
1870-0690	IC 1/2" 16-INPUT	24480	1870-0690	1
1870-0691	IC 1/2" 16-INPUT	24480	1870-0691	1
1870-0692	IC 1/2" 16-INPUT	24480	1870-0692	1
1870-0693	IC 1/2" 16-INPUT	24480	1870-0693	1
1870-0694	IC 1/2" 16-INPUT	24480	1870-0694	1
1870-0695	IC 1/2" 16-INPUT	24480	1870-0695	1
1870-0696	IC 1/2" 16-INPUT	24480	1870-0696	1
1870-0697	IC 1/2" 16-INPUT	24480	1870-0697	1
1870-0698	IC 1/2" 16-INPUT	24480	1870-0698	1
1870-0699	IC 1/2" 16-INPUT	24480	1870-0699	1
1870-0700	IC 1/2" 16-INPUT	24480	1870-0700	1
1870-0701	IC 1/2" 16-INPUT	24480	1870-0701	1
1870-0702	IC 1/2" 16-INPUT	24480	1870-0702	1
1870-0703	IC 1/2" 16-INPUT	24480	1870-0703	1
1870-0704	IC 1/2" 16-INPUT	24480	1870-0704	1
1870-0705	IC 1/2" 16-INPUT	24480	1870-0705	1
1870-0706	IC 1/2" 16-INPUT	24480	1870-0706	1
1870-0707	IC 1/2" 16-INPUT	24480	1870-0707	1
1870-0708	IC 1/2" 16-INPUT	24480	1870-0708	1
1870-0709	IC 1/2" 16-INPUT	24480	1870-0709	1
1870-0710	IC 1/2" 16-INPUT	24480	1870-0710	1
1870-0711	IC 1/2" 16-INPUT	24480	1870-0711	1
1870-0712	IC 1/2" 16-INPUT	24480	1870-0712	1
1870-0713	IC 1/2" 16-INPUT	24480	1870-0713	1
1870-0714	IC 1/2" 16-INPUT	24480	1870-0714	1
1870-0715	IC 1/2" 16-INPUT	24480	1870-0715	1
1870-0716	IC 1/2" 16-INPUT	24480	1870-0716	1
1870-0717	IC 1/2" 16-INPUT	24480	1870-0717	1
1870-0718	IC 1/2" 16-INPUT	24480	1870-0718	1
1870-0719	IC 1/2" 16-INPUT	24480	1870-0719	1
1870-0720	IC 1/2" 16-INPUT	24480	1870-0720	1
1870-0721	IC 1/2" 16-INPUT	24480	1870-0721	1
1870-0722	IC 1/2" 16-INPUT	24480	1870-0722	1
1870-0723	IC 1/2" 16-INPUT	24480	1870-0723	1
1870-0724	IC 1/2" 16-INPUT	24480	1870-0724	1
1870-0725	IC 1/2" 16-INPUT	24480	1870-0725	1
1870-0726	IC 1/2" 16-INPUT	24480	1870-0726	1
1870-0727	IC 1/2" 16-INPUT	24480	1870-0727	1
1870-0728	IC 1/2" 16-INPUT	24480	1870-0728	1
1870-0729	IC 1/2" 16-INPUT	24480	1870-0729	1
1870-0730	IC 1/2" 16-INPUT	24480	1870-0730	1
1870-0731	IC 1/2" 16-INPUT	24480	1870-0731	1
1870-0732	IC 1/2" 16-INPUT	24480	1870-0732	1
1870-0733	IC 1/2" 16-INPUT	24480	1870-0733	1
1870-0734	IC 1/2" 16-INPUT	24480	1870-0734	1
1870-0735	IC 1/2" 16-INPUT	24480	1870-0735	1
1870-0736	IC 1/2" 16-INPUT	24480	1870-0736	1
1870-0737	IC 1/2" 16-INPUT	24480	1870-0737	1
1870-0738	IC 1/2" 16-INPUT	24480	1870-0738	1
1870-0739	IC 1/2" 16-INPUT	24480	1870-0739	1
1870-0740	IC 1/2" 16-INPUT	24480	1870-0740	1
1870-0741	IC 1/2" 16-INPUT	24480	1870-0741	1
1870-0742	IC 1/2" 16-INPUT	24480	1870-0742	1
1870-0743	IC 1/2" 16-INPUT	24480	1870-0743	1
1870-0744	IC 1/2" 16-INPUT	24480	1870-0744	1
1870-0745	IC 1/2" 16-INPUT	24480	1870-0745	1
1870-0746	IC 1/2" 16-INPUT	24480	1870-0746	1
1870-0747	IC 1/2" 16-INPUT	24480	1870-0747	1
1870-0748	IC 1/2" 16-INPUT	24480	1870-0748	1
1870-0749	IC 1/2" 16-INPUT	24480	1870-0749	1
1870-0750	IC 1/2" 16-INPUT	24480	1870-0750	1
1870-0751	IC 1/2" 16-INPUT	24480	1870-0751	1
1870-0752	IC 1/2" 16-INPUT	24480	1870-0752	1
1870-0753	IC 1/2" 16-INPUT	24480	1870-0753	1
1870-0754	IC 1/2" 16-INPUT	24480	1870-0754	1
1870-0755	IC 1/2" 16-INPUT	24480	1870-0755	1
1870-0756	IC 1/2" 16-INPUT	24480	1870-0756	1
1870-0757	IC 1/2" 16-INPUT	24480	1870-0757	1
1870-0758	IC 1/2" 16-INPUT	24480	1870-0758	1
1870-0759	IC 1/2" 16-INPUT	24480	1870-0759	1
1870-0760	IC 1/2" 16-INPUT	24480	1870-0760	1
1870-0761	IC 1/2" 16-INPUT	24480	1870-0761	1
1870-0762	IC 1/2" 16-INPUT	24480	1870-0762	1
1870-0763	IC 1/2" 16-INPUT	24480	1870-0763	1
1870-0764	IC 1/2" 16-INPUT	24480	1870-0764	1
1870-0765	IC 1/2" 16-INPUT	24480	1870-0765	1
1870-0766	IC 1/2" 16-INPUT	24480	1870-0766	1
1870-0767	IC 1/2" 16-INPUT	24480	1870-0767	1
1870-0768	IC 1/2" 16-INPUT	24480	1870-0768	1
1870-0769	IC 1/2" 16-INPUT	24480	1870-0769	1
1870-0770	IC 1/2" 16-INPUT	24480	1870-0770	1
1870-0771	IC 1/2" 16-INPUT	24480	1870-0771	1
1870-0772	IC 1/2" 16-INPUT	24480	1870-0772	1
1870-0773	IC 1/2" 16-INPUT	24480	1870-0773	1
1870-0774	IC 1/2" 16-INPUT	24480	1870-0774	1
1870-0775	IC 1/2" 16-INPUT	24480	1870-0775	1
1870-0776	IC 1/2" 16-INPUT	24480	1870-0776	1
1870-0777	IC 1/2" 16-INPUT	24480	1870-0777	1
1870-0778	IC 1/2" 16-INPUT	24480	1870-0778	1
1870-0779	IC 1/2" 16-INPUT	24480	1870-0779	1
1870-0780	IC 1/2" 16-INPUT	24480	1870-0780	1
1870-0781	IC 1/2" 16-INPUT	24480	1870-0781	1
1870-0782	IC 1/2" 16-INPUT	24480	1870-0782	1
1870-0783	IC 1/2" 16-INPUT	24480	1870-0783	1
1870-0784	IC 1/2" 16-INPUT	24480	1870-0784	1
1870-0785	IC 1/2" 16-INPUT	24480	1870-0785	1
1870-0786	IC 1/2" 16-INPUT	24480	1870-0786	1
1870-0787	IC 1/2" 16-INPUT	24480	1870-0787	1
1870-0788	IC 1/2" 16-INPUT	24480	1870-0788	1
1870-0789	IC 1/2" 16-INPUT	24480	1870-0789	1
1870-0790	IC 1/2" 16-INPUT	24480	1870-0790	1
1870-0791	IC 1/2" 16-INPUT	24480	1870-0791	1
1870-0792	IC 1/2" 16-INPUT	24480	1870-0792	1
1870-0793	IC 1/2" 16-INPUT	24480	1870-0793	1
1870-0794	IC 1/2" 16-INPUT	24480	1870-0794	1
1870-0795	IC 1/2" 16-INPUT	24480	1870-0795	1
1870-0796	IC 1/2" 16-INPUT	24480	1870-0796	1
1870-0797	IC 1/2" 16-INPUT	24480	1870-0797	1
1870-0798	IC 1/2" 16-INPUT	24480	1870-0798	1
1870-0799	IC 1/2" 16-INPUT	24480	1870-0799	1
1870-0800	IC 1/2" 16-INPUT	24480	1870-0800	1
1870-0801	IC 1/2" 16-INPUT	24480	1870-0801	1
1870-0802	IC 1/2" 16-INPUT	24480	1870-0802	1
1870-0803	IC 1/2" 16-INPUT	24480	1870-0803	1
1870-0804	IC 1/2" 16-INPUT	24480	1870-0804	1
1870-0805	IC 1/2" 16-INPUT	24480	1870-0805	1
1870-0806	IC 1/2" 16-INPUT	24480	1870-0806	1
1870-0807	IC 1/2" 16-INPUT	24480	1870-0807	1
1870-0808	IC 1/2" 16-INPUT	24480	1870-0808	1
1870-0809	IC 1/2" 16-INPUT	24480	1870-0809	1
1870-0810	IC 1/2" 16-INPUT	24480	1870-0810	1
1870-0811	IC 1/2" 16-INPUT	24480	1870-0811	1
1870-0812	IC 1/2" 16-INPUT	24480	1870-0812	1
1870-0813	IC 1/2" 16-INPUT	24480	1870-0813	1
1870-0814	IC 1/2" 16-INPUT	24480	1870-0814	1
1870-0815	IC 1/2" 16-INPUT	24480	1870-0815	1
1870-0816	IC 1/2" 16-INPUT	24480	1870-0816	1
1870-0817	IC 1/2" 16-INPUT	24480	1870-0817	1
1870-0818	IC 1/2" 16-INPUT	24480	1870-0818	1
1870-0819	IC 1/2" 16-INPUT	24480	1870-0819	1
1870-0820	IC 1/2" 16-INPUT	24480	1870-0820	1
1870-0821	IC 1/2" 16-INPUT	24480	1870-0821	1
1870-0822	IC 1/2" 16-INPUT	24480	1870-0822	1
1870-0823	IC 1/2" 16-INPUT	24480	1870-0823	1
1870-0824	IC 1/2" 16-INPUT	24480	1870-0824	1
1870-0825	IC 1/2" 16-INPUT	24480	1870-0825	1
1870-0826	IC 1/2" 16-INPUT	24480	1870-0826	1
1870-0827	IC 1/2" 16-INPUT	24480	1870-0827	1
1870-0828	IC 1/2" 16-INPUT	24480	1870-0828	1
1870-0829	IC 1/2" 16-INPUT	24480	1870-0829	1
1870-0830	IC 1/2" 16-INPUT	24480	1870-0830	

See introduction to this section for ordering information

Part No.	Description #	Mfr.	Mfr. Part No.	TU
1901-0028	DIODE 1N1111 IECN 0.75A 400PIV	CAF13	581358-9	4
1901-0040	DIODE 1N1111 IECN 100A 100V	CAF23	581358-9	4
1901-0049	DIODE 1N1111 IECN 500PIV	28480	1901-0049	1
1901-0070	DIODE 1N1111 IECN 100 PIV 1A	CAF23	184555	1
1901-0076	DIODE 1N1111 IECN 15V	28480	1901-0076	1
1901-0081	DIODE STABISTOR	CAF23	184555	1
1902-1094	DIODE 1N4001 0.5A 100V 75	28480	1902-1094	1
1902-1114	DIODE 1N4001 0.5A 100V 75	28480	1902-1114	1
1902-1194	DIODE 1N4001 0.5A 100V 75	28480	1902-1194	1
1902-1474	DIODE 1N4001 0.5A 100V 75	28480	1902-1474	1
1910-0016	DIODE 1N4001 0.5A 100V 75	CAF23	D2361	1
1910-0022	DIODE 1N4001 0.5A 100V 75	28480	1910-0022	1
1910-0031	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0035	DIODE 1N4001 0.5A 100V 75	28480	1910-0035	1
1910-0038	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0040	DIODE 1N4001 0.5A 100V 75	28480	1910-0040	1
1910-0042	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0044	DIODE 1N4001 0.5A 100V 75	28480	1910-0044	1
1910-0046	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0048	DIODE 1N4001 0.5A 100V 75	28480	1910-0048	1
1910-0050	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0052	DIODE 1N4001 0.5A 100V 75	28480	1910-0052	1
1910-0054	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0056	DIODE 1N4001 0.5A 100V 75	28480	1910-0056	1
1910-0058	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0060	DIODE 1N4001 0.5A 100V 75	28480	1910-0060	1
1910-0062	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0064	DIODE 1N4001 0.5A 100V 75	28480	1910-0064	1
1910-0066	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0068	DIODE 1N4001 0.5A 100V 75	28480	1910-0068	1
1910-0070	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0072	DIODE 1N4001 0.5A 100V 75	28480	1910-0072	1
1910-0074	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0076	DIODE 1N4001 0.5A 100V 75	28480	1910-0076	1
1910-0078	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0080	DIODE 1N4001 0.5A 100V 75	28480	1910-0080	1
1910-0082	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0084	DIODE 1N4001 0.5A 100V 75	28480	1910-0084	1
1910-0086	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0088	DIODE 1N4001 0.5A 100V 75	28480	1910-0088	1
1910-0090	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0092	DIODE 1N4001 0.5A 100V 75	28480	1910-0092	1
1910-0094	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0096	DIODE 1N4001 0.5A 100V 75	28480	1910-0096	1
1910-0098	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0100	DIODE 1N4001 0.5A 100V 75	28480	1910-0100	1
1910-0102	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0104	DIODE 1N4001 0.5A 100V 75	28480	1910-0104	1
1910-0106	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0108	DIODE 1N4001 0.5A 100V 75	28480	1910-0108	1
1910-0110	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0112	DIODE 1N4001 0.5A 100V 75	28480	1910-0112	1
1910-0114	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0116	DIODE 1N4001 0.5A 100V 75	28480	1910-0116	1
1910-0118	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0120	DIODE 1N4001 0.5A 100V 75	28480	1910-0120	1
1910-0122	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0124	DIODE 1N4001 0.5A 100V 75	28480	1910-0124	1
1910-0126	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0128	DIODE 1N4001 0.5A 100V 75	28480	1910-0128	1
1910-0130	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0132	DIODE 1N4001 0.5A 100V 75	28480	1910-0132	1
1910-0134	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0136	DIODE 1N4001 0.5A 100V 75	28480	1910-0136	1
1910-0138	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0140	DIODE 1N4001 0.5A 100V 75	28480	1910-0140	1
1910-0142	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0144	DIODE 1N4001 0.5A 100V 75	28480	1910-0144	1
1910-0146	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0148	DIODE 1N4001 0.5A 100V 75	28480	1910-0148	1
1910-0150	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0152	DIODE 1N4001 0.5A 100V 75	28480	1910-0152	1
1910-0154	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0156	DIODE 1N4001 0.5A 100V 75	28480	1910-0156	1
1910-0158	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0160	DIODE 1N4001 0.5A 100V 75	28480	1910-0160	1
1910-0162	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0164	DIODE 1N4001 0.5A 100V 75	28480	1910-0164	1
1910-0166	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0168	DIODE 1N4001 0.5A 100V 75	28480	1910-0168	1
1910-0170	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0172	DIODE 1N4001 0.5A 100V 75	28480	1910-0172	1
1910-0174	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0176	DIODE 1N4001 0.5A 100V 75	28480	1910-0176	1
1910-0178	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0180	DIODE 1N4001 0.5A 100V 75	28480	1910-0180	1
1910-0182	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0184	DIODE 1N4001 0.5A 100V 75	28480	1910-0184	1
1910-0186	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0188	DIODE 1N4001 0.5A 100V 75	28480	1910-0188	1
1910-0190	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0192	DIODE 1N4001 0.5A 100V 75	28480	1910-0192	1
1910-0194	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0196	DIODE 1N4001 0.5A 100V 75	28480	1910-0196	1
1910-0198	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0200	DIODE 1N4001 0.5A 100V 75	28480	1910-0200	1
1910-0202	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0204	DIODE 1N4001 0.5A 100V 75	28480	1910-0204	1
1910-0206	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0208	DIODE 1N4001 0.5A 100V 75	28480	1910-0208	1
1910-0210	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0212	DIODE 1N4001 0.5A 100V 75	28480	1910-0212	1
1910-0214	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0216	DIODE 1N4001 0.5A 100V 75	28480	1910-0216	1
1910-0218	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0220	DIODE 1N4001 0.5A 100V 75	28480	1910-0220	1
1910-0222	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0224	DIODE 1N4001 0.5A 100V 75	28480	1910-0224	1
1910-0226	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0228	DIODE 1N4001 0.5A 100V 75	28480	1910-0228	1
1910-0230	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0232	DIODE 1N4001 0.5A 100V 75	28480	1910-0232	1
1910-0234	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0236	DIODE 1N4001 0.5A 100V 75	28480	1910-0236	1
1910-0238	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0240	DIODE 1N4001 0.5A 100V 75	28480	1910-0240	1
1910-0242	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0244	DIODE 1N4001 0.5A 100V 75	28480	1910-0244	1
1910-0246	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0248	DIODE 1N4001 0.5A 100V 75	28480	1910-0248	1
1910-0250	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0252	DIODE 1N4001 0.5A 100V 75	28480	1910-0252	1
1910-0254	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0256	DIODE 1N4001 0.5A 100V 75	28480	1910-0256	1
1910-0258	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0260	DIODE 1N4001 0.5A 100V 75	28480	1910-0260	1
1910-0262	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0264	DIODE 1N4001 0.5A 100V 75	28480	1910-0264	1
1910-0266	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0268	DIODE 1N4001 0.5A 100V 75	28480	1910-0268	1
1910-0270	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0272	DIODE 1N4001 0.5A 100V 75	28480	1910-0272	1
1910-0274	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0276	DIODE 1N4001 0.5A 100V 75	28480	1910-0276	1
1910-0278	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0280	DIODE 1N4001 0.5A 100V 75	28480	1910-0280	1
1910-0282	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0284	DIODE 1N4001 0.5A 100V 75	28480	1910-0284	1
1910-0286	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0288	DIODE 1N4001 0.5A 100V 75	28480	1910-0288	1
1910-0290	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0292	DIODE 1N4001 0.5A 100V 75	28480	1910-0292	1
1910-0294	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0296	DIODE 1N4001 0.5A 100V 75	28480	1910-0296	1
1910-0298	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0300	DIODE 1N4001 0.5A 100V 75	28480	1910-0300	1
1910-0302	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0304	DIODE 1N4001 0.5A 100V 75	28480	1910-0304	1
1910-0306	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0308	DIODE 1N4001 0.5A 100V 75	28480	1910-0308	1
1910-0310	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0312	DIODE 1N4001 0.5A 100V 75	28480	1910-0312	1
1910-0314	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0316	DIODE 1N4001 0.5A 100V 75	28480	1910-0316	1
1910-0318	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0320	DIODE 1N4001 0.5A 100V 75	28480	1910-0320	1
1910-0322	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0324	DIODE 1N4001 0.5A 100V 75	28480	1910-0324	1
1910-0326	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0328	DIODE 1N4001 0.5A 100V 75	28480	1910-0328	1
1910-0330	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0332	DIODE 1N4001 0.5A 100V 75	28480	1910-0332	1
1910-0334	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0336	DIODE 1N4001 0.5A 100V 75	28480	1910-0336	1
1910-0338	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0340	DIODE 1N4001 0.5A 100V 75	28480	1910-0340	1
1910-0342	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0344	DIODE 1N4001 0.5A 100V 75	28480	1910-0344	1
1910-0346	DIODE 1N4001 0.5A 100V 75	CAF23	184555	1
1910-0348	DIODE 1N4001 0.5A 100V 75	28480	1910-0348	1
1910-0350	DIODE 1N4001 0.5A 100V			

See introduction to this section for ordering information

Model 5325B

Table 6-2. Replaceable Parts Index

#. For introduction to this system for ordering information

Table 6-3. Code List of Manufacturers

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 (Name to Code) and H4-2 (Code to Name) and their latest supplements.

Code No.	Manufacturer	Address
01121	Allen Bradley Co.	Milwaukee, Wis.
01295	Texas Instruments, Inc. Transistor Products Div.	Dallas, Texas
02660	Amphenol-Borg Electronics Corp.	Broadview, Ill.
02735	Radio Corp. of America, Semiconductor and Materials Div.	Somerville, N.J.
03608	G.E. Semiconductor Prod. Dept.	Syracuse, N.Y.
04062	Arco Electronic Inc.	Great Neck, N.Y.
04713	Motorola, Inc., Semiconductor Prod. Div.	Phoenix, Arizona
07233	Cinch-Graphik Co.	City of Industry, California
07263	Fairchild Camera & Inst. Corp. Semiconductor Div.	Mountain View, California
06717	Sloan Company	Sun Valley, California
24455	G.E. Lamp Division	Nela Park, Cleveland, Ohio
28480	Hewlett-Packard Co.	Palo Alto, California
56289	Sprague Electric Co.	North Adams, Mass.
71400	Bussman Mfg. Div. of McGraw-Edison Co.	St. Louis, Missouri
71690	Centralab Div. of Globe Union Inc.	Milwaukee, Wisconsin
71785	Cinch Mfg. Co., Howard B. Jones Div.	Chicago, Illinois
72136	Electro Motive Mfg. Co., Inc.	Willimantic, Connecticut
72982	Erie Technological Products, Inc.	Erie, Pa.
75916	Littlefuse, Inc.	Des Plaines, Illinois
77630	TRW Electronic Components Div.	Camden, New Jersey
79727	Continental-Wirt Electronics Corp.	Philadelphia, Pa.
82376	Astron Corp.	East Newark, Harrison, N.J.
82389	Switchcraft, Inc.	Chicago, Illinois
82647	Metals & Controls Inc. Spencer Products	Attleboro, Mass.
83594	Burroughs Corp. Electronic Tube Div.	Plainfield, N.J.
84411	TRW Capacitor Div.	Ogallala, Nebraska
87930	Tower Mfg. Corp.	Providence, R.I.
91418	Radio Materials Co.	Chicago, Illinois
93332	Sylvania Electric Products Inc. Semiconductor Division	Woburn, Mass.
99800	Delevan Electronics Corp.	East Aurora, New York

From: FSC. Handbook Supplements

BACK DATING MANUAL CHANGES

SECTION VII

OPTIONS AND MANUAL CHANGES

7-1. OPTIONS

7-2. The Counter is available with Option 01, remote programmable input attenuator and AC-DC switches. Option 01 consists of printed circuit assembly 05325-60041 which replaces standard input attenuator A1. The Option 01 remote programmable input attenuator provides the AC-DC, X1, X10, and X100 attenuating functions with relays. Table 7-2 lists the relay actions. Figure 7-1 is the schematic diagram. Figure 7-2 is the component location. Parts list is Table 7-1. For connection information, refer to Figures 7-1 and 7-2.

To program the attenuators and the input coupling mode, the front-panel ATTN switches for CHANNEL A and CHANNEL B must be set to X1, and the AC/DC switches for both channels must be set at AC.

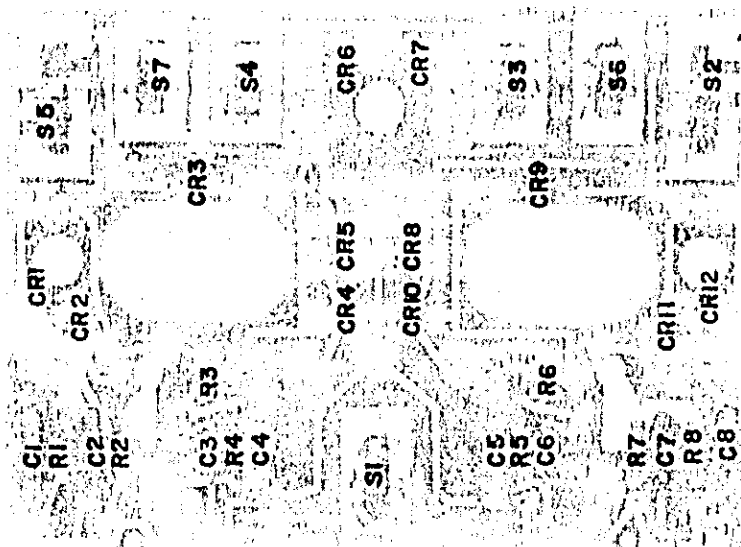
7-3. MANUAL CHANGES

7-4. CURRENT INSTRUMENTS. This manual applies directly to Model 5325B Counters with serial prefix 1216A.

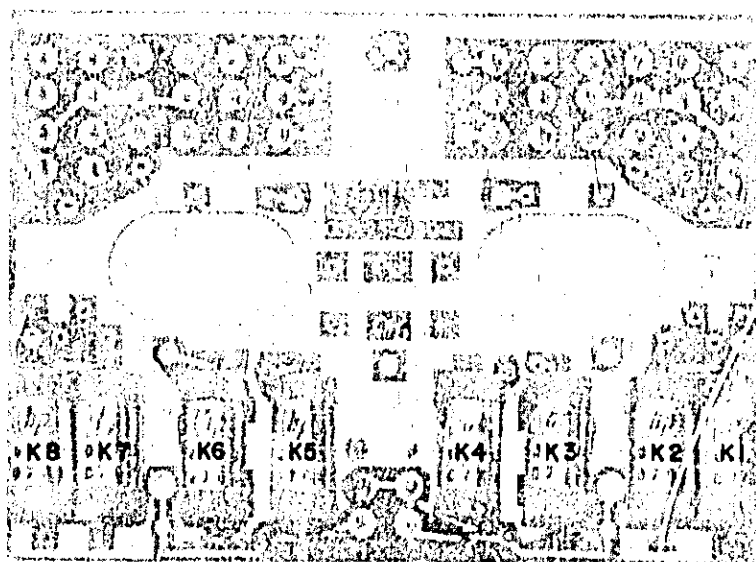
7-5. NEWER INSTRUMENTS. As changes are made, newer instruments may have serial prefixes not listed in this manual. The manuals for these instruments will include a "Manual Changes" sheet containing the required information; contact the nearest Hewlett-Packard Sales and Service Office if this sheet is missing.

7-6. OLDER INSTRUMENTS. This manual with changes listed in Table 7-3 applies to instruments with serial prefixes earlier than 1216A as noted. The numbered CHANGES follow Table 7-3.

Figure 7-1. 05325-00041 Remote Attenuator Parts Location



FRONT



REAR

Table 7-1. Option 01 Parts List

REFERENCE DESIGNATION	DESCRIPTION	HP PART NO.
C1	C: Fxd, dipped mica. 534 pf 1%	0160-0339
C2	C: Fxd, mica. 20 pf, 5%, 200 vdew	0160-2198
C3	C: Fxd, ti diox, 5.6 pf 500 vdew	0150-0044
C4	C: Fxd, my, 0.018 mf, 10% 200 vdew	0160-0302
C5	C: Fxd, my, 0.018 mf, 10% 200 vdew	0160-0302
C6	C: Fxd, ti diox, 5.6 pf 500 vdew	0150-0044
C7	C: Fxd, mica, 20 pf 5%, 300 vdew	0160-2198
C8	C: Fxd, dipped mica. 534 pf, 1%	0160-0330
CR1-2	Diode, Si	1901-0040
CR3	Diode, Ge	1910-0040
CR4-5	Diode, Si	1901-0040
CR6-7	Diode, Ge	1910-0040
CR8	Diode, Si	1901-0040
CR9	Diode, Ge	1910-0016
CR10-12	Diode, Si	1901-0016
K1-8	Relay Reed .1 amp	0490-0764
R1	R: Fxd, comp. 10K ohm 5%, 1/4W	0683-1035
R2	R: Fxd, comp. 120K ohm 5%, 1/4W	0683-1245
R3	R: Fxd, comp. 1K ohm 5%, 1/4W	0683-1025
R4	R: Fxd, comp. 1Meg ohm 5%, 1/4W	0683-1055
R5	R: Fxd, comp. 1Meg ohm 5%, 1/4W	0683-1055
R6	R: Fxd, comp. 1K ohm 5%, 1/4W	0683-1025
R7	R: Fxd, comp. 120K ohm 5%, 1/4W	0683-1245
R8	R: Fxd, comp. 10K ohm 5%, 1/4W	0683-1035
S1	Switch, slide	3101-1598
S2	Switch, slide	3101-1596
S3-4	Switch, slide	3101-1598
S5	Switch, slide	3101-1596
S6	Switch, slide	3101-1598
S7	Switch, slide	3101-1596

Table 7-2. Remote Programmable Input Attenuator Relay Action

Either a Pin on J8 Must be Grounded or a Panel Switch Actuated		To Energize a Relay
Ground on J8 Pin	Switch Position (Also Shows Function Selected)	A1 Relay Energized
	CHANNEL A S5 ATTEN	
25	X1	K6
9	X10	K7
3	X100	K8
	S6	
None	AC	None
7	DC	K5
	CHANNEL B S2 ATTEN	
50	X1	K3
3	X10	K2
12	X100	K1
	S7	
None	AC	None
10	DC	K4

Table 7-3. Manual Changes for Older Instruments

For Serial Prefix Number	Make These Changes
820 (5325A)	1 thru 12
832 (5325A)	2 thru 12
844 (5325A)	3 thru 12
846 (5325A)	4 thru 12
904 (5325B)	5 thru 12
930 (5325B)	6 thru 12
932 (5325B)	7 thru 12
936 (5325B)	8 thru 12
964 (5325B)	9 thru 12
1044A (5325B)	10 thru 12
1112A (5325B)	11 and 12
1216A (5325B)	12

CHANGE 1:

Figure 7-5, A1/A2 schematic:
Delete A2C20.
Change value A2R3 to 82 OHM.

CHANGE 2:

Section VI, Table 6-1, Page 6-0:
Delete C5 and C6 - 0180-0210 - C:FXD Tant 3.3 μ F \pm 20% 15VDCW.

Section VII, Figure 7-5 (A1)
Delete C5 and C6 (3.3 μ F) on left side outside A1.

CHANGE 3:

Section VII

Table 7-5 (A2) - Delete A2R44 F:FXD Comp 51 Ohm 5% 1/4W.
Table 7-8 (A8) - Change A8C17 to 0140-0149 C:FXD Mica 470 PF 5% 300VDCW.
Table 7-8 (A8) - Change A8CR41 through A4CR46 to 1901-0040 Diode Silicon 30MA 30WV.
Table 7-8 (A8) - Change A8R36 to 0683-2035 R:FXD Comp 20K ohm 5% 1/4W.
Figure 7-5 (A2 Schematic) - Delete A2R44 (Ω) and show connection through R44 terminals.
Figure 7-11 (A8 Schematic) - Change A8C17 from 82 PF to 470 PF.
Figure 7-11 (A8 Schematic) - Change A8R36 from 13K to 20K.

CHANGE 4

Section I, Page 1-2:

Table 1-3 Revise two items (Range and Sensitivity) under INPUT CHANNELS A and B to read:

Range: dc coupled: 0-12.5 MHz
ac coupled: 10 Hz to 12.5 MHz

Sensitivity: 0.1 V rms sine wave. 0.3 V p-p pulse, 50 ns minimum pulse width.

Section III, Page 3-3:

Figure 3-2, (FREQ measurement) change item 9 to read:

9. Connect signal to be counted to CHANNEL A INPUT (10 Hz to 12.5 MHz).

Page 3-7.

Figure 3-7 (RATIO A/B measurement) change item 9 to read:

9. Connect higher frequency to CHANNEL A INPUT (10 Hz to 12.5 MHz).

CHANGE 4

Section VII (Continued)

Page 3-12.

Table 3-2 (J8 connections), change wire colors under general to read:

General

+ SLOPE A	WHT-ORN-GY
- SLOPE A	WHT-RED-GY
LEVEL A	WHT-YEL-GY
+ SLOPE B	WHT-ORN-VIO
- SLOPE B	WHT-VIO-GY
LEVEL B	YEL

Section IV, Page 4-2:

Delete Paragraph 4-16 and replace with the following paragraph:

This circuit amplifies Channel A and B input signals from A1, gives marker output for oscilloscope intensity modulation, and drives function selector assembly A4. The circuit consists of an FET input differential amplifier, differential Schmitt trigger, and an output one-shot MV. The differential amplifier, coupled with the differential Schmitt trigger, provide very accurate and stable triggering. R10 balances the differential amplifier and is adjusted for maximum sensitivity at 12.5 MHz with a sinewave input and LEVEL control set to PRESET. SLOPE and LEVEL may be programmed from J8 (REMOTE PROGRAM connector) when Function Selector switch S5 is set to EXT. The LEVEL controls must be set to PRESET for remote programming.

Page 4-5.

Paragraph 4-43, add the following sentence:

"Breakdown diodes CR8 and CR9 clamp the B+ voltage to digital display tubes."

Page 4-5:

Delete Paragraph 4-46 and 4-47 and replace with the following paragraph:

+170 AND +5.1 VOLT SUPPLY A11

This circuit supplies +5.1 V and +170 V. The +170 volt supply goes to display board A9 and operates the digital display tubes. The +5.1 V supply is used primarily to operate integrated circuits throughout the instrument.

Section V, Table 5-3, Page 5-3:

Revise item 1 under FREQUENCY to read:

Range: 0 to 12.5 MHz.

Page 5-6:

Revise item under RATIO A/D: to read:

Range: Channel A: 0 to 12.5 MHz.

Page 5-9:

Revise FREQUENCY item under DESCRIPTION and CHECK to read: FREQUENCY

1. Range: 0 to 12.5 MHz 10 Hz to 12.5 MHz

Page 5-9:

Revise RATIO items to read: Range: Channel A: 0 to 12.5 MHz

Page 5-10:

Revise FREQUENCY item under DESCRIPTION and CHECK to read: FREQUENCY

1. Range: 0 to 12.5 MHz 10 Hz to 12.5 MHz

Page 5-10:

Revise RATIO item to read: Range: Channel A: 0 to 12.5 MHz

Section VI:

Figure 6-1 (Cabinet Parts), Item 2: Change number under HP Part No. from 05325-00012 to 05325-00003

CHANGE 4 (Continued):

Section IV (Continued):

Page 6-3, Table 6-1:

Delete A1-05325-60040 Input Attenuator Assy and all lines prefixed by A1; replace with Table 7-4 (A1-05325-60009 Input Attenuator Assy).

Page 6-3, Table 6-1:

Delete A2-05325-60036 Amplifier/Trigger Assy and all line prefixed by A2; replace with Table 7-5 (A-05325-60001 Amplifier Trigger Assy).

Page 6-5, Table 6-1:

Change A4IC6 from 1820-0380 to 1820-0074.

Page 6-8, Table 6-1:

After all A9 prefixed lines add Table 7-9 (A9CR1-A9CR9 Diodes)

Page 6-9, Table 6-1:

Delete A11-05325-60022 Power Supply No. 2 and all lines prefixed A11; replace with Table 7-10 (A11-05325-60001 Power Supply No. 2).

Page 6-9, Table 6-1:

Add the following parts:

C1	0170-0055	C:FXD MY 0.1UF 20% 200VDCW
C2	0170-0055	C:FXD MY 0.1UF 20% 200VDCW
C3	0170-0055	C:FXD MY 0.1UF 20% 200VDCW
J9	1251-0148	Connector: Power 3 pin Male.

Pages 6-9 and 6-10:

Delete the following parts:

C7, C8, and C9	- 0180-0120	C:FXD Tant 3.3μf 20% 15VDCW
XW1	1251-0148	Power Connector 3 Pin Male
L3, L4, and L5	- 9140-0014	Coil/Choke 10μH 10%
L6	9100-2265	Coil/Choke 10μH 10%.

Pages 6-9 and 6-10:

Change the following part descriptions:

S1 from NSR part of R1 to NOT ASSIGNED
S6 from NSR part of R2 to NOT ASSIGNED
S7 from NSR part of R3 to NOT ASSIGNED

Section VIII:

Figures 8-2 through 8-8 and Figure 8-17, change A4IC6 from 1820-0380 to 1820-0074.
Delete Figure 8-16 (A1, A2, and A3 Schematic) and replace with Figure 7-5 (A1, A2/A3-05325-60001 Schematic) and Figure 7-4 (A1, A2-A3 Parts Location).
Figure 8-19 (A7 Schematic) Outside A7 add C3 0.1μF at pins 5-8 to ground.
Delete Figure 8-21 (A9, A12 Schematic) and replace with Figure 7-13 (A9/A12 05325-60011/60010 Display/Annunciator Schematic) and Figure 7-12 (A9/A12 Parts Location).
Delete Figure 8-22 (A10, A11 Schematic) and replace with Figure 7-15 (A10/A11 05325-60005/60006 Power Supply Schematic) and Figure 7-14 (A10 and A11 Parts Location).

CHANGE 5:

Section VII

Delete Figure 7-1 (A1-01 005325-60041 Attenuator Schematic) and replace with Figure 7-17 (A1-01 05325-60033 Attenuator Schematic).

The Counter is available with Option 01, remote programmable input attenuator and AC-DC switches. Option 01 consists of printed circuit assembly 05325-60033 which replaces standard input attenuator A1. To program the attenuator and the input coupling mode, the front panel controls must be set to X1 and the AC-DC switches to AC. For connection information refer to Table 7-11. Figure 7-17 is the schematic diagram. Figure 7-16 is the component locator. Parts list is Table 7-17.

Delete Figure 7-2 (A1-01 Parts Location) and replace with Figure 7-16 (A1-01 05325-60033 Attenuator Parts Location).

Delete Table 7-1 (A1-01 Parts List) and replace with Table 7-12 (A1-01 05325-60033 Attenuator Parts List).

Delete J8 Remote Program Connector Schematic from Figure 8-24 and replace with Figure 7-21 (J8).

Add Table 7-11 (Connections to REMOTE PROGRAM connector J8).

Delete Table 7-2 (Relay Action).

CHANGE 6:

Section IV, Page 4-3, Paragraph 4-16:

Change last sentence to read: "R10 balances the differential amplifier and is adjusted for maximum sensitivity at 20 MHz (A2), 12.5 MHz (A3) with a sinewave input and LEVEL control set to PRESET."

Table 6-1, Pages 6-4 and 6-5:

Delete A3-05325-60035 Amplifier/Trigger Assembly and all lines prefixed by A3; replace with Table 7-5 (A3-05325-60001 Amplifier/Trigger Assembly).

Section VIII, Figure 8-16:

Add NOTE - Refer to Figure 7-19 for A3-05325-60001 Amplifier/Trigger Schematic Diagram and Figure 7-18 Amplifier/Trigger Parts Location.

CHANGE 7:

Section VI, Table 6-1, Page 6-10:

Change W1 to 05325-60013 Switch Assembly: Time Base (Including S4, W1b, and W19).

Change W2 to 05325-60014 Cable Assembly: Function Selector.

Change W3 to 05325-60015 Cable Assembly: Power.

Add W6, 05325-60017 Cable Assembly: Sample.

Add W20, 05325-60027 Cable Assembly: Function Selector

CHANGE 8:

Section VI, Table 6-1, Page 6-5:

Delete A4-05325-60046 Assembly: Function Selector and all lines prefixed by A4; replace with Table 7-6 (A4-05325-60003 Assembly: Function Selector).

Page 6-5:

Delete A5-05325-60048 Assembly: Time Base Board and all lines prefixed by A5; replace with Table 7-7 (A5-05325-60004 Assembly: Time Base Board).

Pages 6-6, 6-7, 6-8, and 6-9:

Delete A8-05325-60047 Assembly: Counter Board and all lines prefixed by A8; replace with Table 7-8 (A8-05325-60007 Assembly: Counter Board).

Section VIII

Delete Figure 8-17 (A4 Function Selector Schematic), and replace with Figure 7-7 (A4-05325-60003 Function Selector Schematic).

Delete Figure 8-18 (A5 Time Base Schematic), and replace with Figure 7-9 (A5-05325-60004 Time Base Schematic) and Figure 7-8 (A5-05325-60004 Time Base Parts Location).

Delete Figure 8-20 (A8 Counter Board Schematic) and replace with Figure 7-11 (A8-05325-60007 Counter Board Schematic) and Figure 7-10 (A8-05325-60007 Counter Board Parts Location).

Delete Figure 8-15 (Block Diagram), and replace with Figure 7-3 (Block Diagram)

CHANGE 9:

Page 1-1, Table 1-1:

Change power cable Part No. to 8120-0078.

Page 2-0, Paragraph 2-11:

Change 115 volt fuse to 0.5 ampere; 230 volt fuse to 0.25 ampere.

Page 6-10, Table 6-1:

Change XW1 from 1251-2357 to 1251-0148.

Change F1 from 2110-0016 0.3 amp to 2110-0008 0.5 amp.

Change F1 from 2110-0044 0.3 amp to 2110-0018 0.25 amp.

Change S1C from 3101-1234 to 3101-0033.

CHANGE 10:

Page 1-3, Table 1-3:

Delete specifications headed External Input; replace with following:

External Input:	1 MHz	1.0 V rms
	2.5 MHz	1.0 V rms
	5 MHz	1.0 V rms
	10 MHz	1.0 V rms

Page 6-6, Table 6-1:

Change A7 from 05325-60049 Series 1044A to 05325-60008.

Change A7 from 05325-20049 to 05325-20008.

Delete 05325-60049 Series 1044A parts (Table 7-) and replace with 05325-60008 parts (Table 7-).

Page 8-28:

Replace text headed "A7 OPERATION" and "A7 TROUBLESHOOTING" with "A7 ADJUSTMENT" with following:

A7 OPERATION

This assembly includes a 10 MHz oscillator, 10 MHz multiplier, output one-shot MV and a driver. Oscillator frequency and crystal current are adjusted by C5 and R6 respectively. The oscillator section consists of Q1, 2, and 3. The 10 MHz multiplier consists of two tuned amplifiers whose output is shaped by Q7 and Q8. Driver Q9 provides positive pulses at pin 3. With INT-EXT switch S8 set to EXT, operating voltage for the oscillator is disconnected and an external standard frequency (1, 2.5, 5, or 10 MHz) may be connected to OSC jack on rear panel.

A7 TROUBLESHOOTING

Measure DC voltages coming into the board (+12V at pin 14, -12V at pin 15, and +5.1V at pin 4). Make waveform measurements to determine which stage is not operating. If oscillator section is not working, try adjusting R6 following adjustment procedure below. If the preceding checks fail to locate the problem, replace 10 MHz crystal. NOTE: Whenever crystal is changed, R6 and C5 must be adjusted. Be sure to use a 50:1 attenuator probe when making waveform measurements.

A7 ADJUSTMENT

- a. L2, 3, 4, and 5 adjustment:
 1. Set INT-EXT switch to EXT.
 2. Connect 1 MHz standard to OSC jack on rear panel.
 3. Connect Oscilloscope through 50:1 probe to pin 1. NOTE: Do not use extender board during adjustment procedure.
 4. Adjust L2, 3, 4, and 5 for maximum output (should be greater than 0.7V rms, 2V p-p).
- b. R6 and C5 adjustment:
 1. Set INT-EXT switch to INT.
 2. Connect an Electronic Counter to OSC jack on rear panel.
 3. Adjust C5 for 10 MHz (± 1 Hz). NOTE: If crystal or heater (A6 assembly) has been changed it may be necessary to select C4 to permit oscillator to tune to 10 MHz.
 4. Clip a current probe over the orange wire coming from pin 12. Connect probe through probe amplifier to Oscilloscope. Set Oscilloscope to .05V/cm and current probe amplifier to 5 mA/cm.
 5. Adjust R6 for 20 mV p-p on Oscilloscope. Remove current probe and reposition orange wire close to board before proceeding.
 6. Readjust C5 for 10 MHz ± 1 count on Test Counter.
 7. After cover replacement, recheck frequency and readjust C5 if necessary. It may be necessary to adjust C5 several counts OFF frequency to compensate for the effects of cover replacement.

CHANGE 10 (Cont'd)

Delete A6/A7 schematic and replace with A6/A7 (05325-60008) schematic;
Delete A6/A7 component locator and replace with A6/A7 (05325-60008) photo:

CHANGE 11

Page 6-6, Table 6-1:

Change A7 (05325-60049) from Series 1112 to 1044.

Delete parts list Series 1112; replace with parts list Series 1044.

Replace A6/A7 component locator Series 1112 with A7.

component locator Series 1044.

Replace A6/A7 schematic Series 1112 with Series 1044 schematic.

CHANGE 12

Replace parts list for A7 (05325-60050) REV A SERIES 1216
with list for (05325-60049) REV B SERIES 1112.

Replace A7 (05325-60050) component locator with
A7 (05325-60049) SERIES 1112 photo.

Add A6 05325-60012 CRYSTAL/OVEN assy component locator.

Replace A7 schematic (05325-60050) SERIES 1216 with A6/A7 schematic (05325-60049) SERIES 1112.

Section VII
Options and Manual Changes

Model 5325B

Table 7-5. 05325-60001 Amplifier/Trigger Parts (Continued)

Reference Designation	Part No.	Description #
A2P12	0683-1115	REFD COMP 100 OHM 5% 1/4W
A2P13	0683-1115	REFD COMP 500 OHM 5% 1/4W
A2P14	0683-1535	REFD COMP 15K OHM 5% 1/4W
A2P15	0683-1102	REFD COMP 51 OHM 5% 1/4W
A2P16	0683-6615	REFD COMP 680 OHM 5% 1/4W
A2P17	0683-1535	REFD COMP 15K OHM 5% 1/4W
A2P18	0683-1115	REFD COMP 500 OHM 5% 1/4W
A2P19	0683-1115	REFD COMP 500 OHM 5% 1/4W
A2P20	0683-1115	REFD COMP 500 OHM 5% 1/4W
A2P21	0683-2725	REFD COMP 270 OHM 5% 1/4W
A2P22	0683-1025	REFD COMP 1000 OHM 5% 1/4W
A2P23	0683-2725	REFD COMP 2700 OHM 5% 1/4W
A2P24	0683-1535	REFD COMP 15K OHM 5% 1/4W
A2P25	0683-1735	REFD COMP 12K OHM 5% 1/4W
A2P26	0683-1735	REFD COMP 12K OHM 5% 1/4W
A2P27	0683-1535	REFD COMP 15K OHM 5% 1/4W
A2P28	0683-2725	REFD COMP 2700 OHM 5% 1/4W
A2P29	0683-2725	REFD COMP 270 OHM 5% 1/4W
A2P30	0683-2725	REFD COMP 270 OHM 5% 1/4W
A2P31	0683-6215	REFD COMP 620 OHM 5% 1/4W
A2P32	0683-6215	REFD COMP 620 OHM 5% 1/4W
A2P33	0683-6225	REFD COMP 6200 OHM 5% 1/4W
A2P34	0683-6225	REFD COMP 6200 OHM 5% 1/4W
A2P35	0683-6225	REFD COMP 620 OHM 5% 1/4W
A2P36	0683-6225	REFD COMP 620 OHM 5% 1/4W
A2P37	0683-6225	REFD COMP 620 OHM 5% 1/4W
A2P38	0683-6225	REFD COMP 620 OHM 5% 1/4W
A2P39	0683-6225	REFD COMP 620 OHM 5% 1/4W
A2P40	0683-6225	REFD COMP 620 OHM 5% 1/4W
A2P41	0683-6225	REFD COMP 620 OHM 5% 1/4W
A2P42	0683-6225	REFD COMP 620 OHM 5% 1/4W
A2P43	0683-6225	REFD COMP 620 OHM 5% 1/4W
A2P44	0683-6225	REFD COMP 620 OHM 5% 1/4W

See Introduction to this section for ordering information

Table 7-6. 05325-60003 Function Selector Parts

Reference Designation	Part No.	Description #
AS	05325-60003	AS-1/FUNCTION SELECTOR BOARD
AS	05325-20003	DISAPPEARANCE PC
AAE1	0197-0291	REFD ELCT 100 10% 15VDCM
AAE31	1917-0016	USER-SEMANUM 100MA AT 0.85V CPM
AAE32	1910-0016	USER-SEMANUM 100MA AT 0.85V CPM
AAE33	1920-0054	INTEGRATED CIRCUIT
AAE34	1920-0054	INTEGRATED CIRCUIT
AAE35	1920-0054	INTEGRATED CIRCUIT
AAE36	1920-0054	INTEGRATED CIRCUIT
AAE37	1920-0054	INTEGRATED CIRCUIT
AAE38	1920-0054	INTEGRATED CIRCUIT
AAE39	1920-0054	INTEGRATED CIRCUIT
AAE40	1920-0054	INTEGRATED CIRCUIT
AAE41	1920-0054	INTEGRATED CIRCUIT
AAE42	1920-0054	INTEGRATED CIRCUIT
AAE43	1920-0054	INTEGRATED CIRCUIT
AAE44	1920-0054	INTEGRATED CIRCUIT
AAE45	1920-0054	INTEGRATED CIRCUIT
AAE46	1920-0054	INTEGRATED CIRCUIT
AAE47	1920-0054	INTEGRATED CIRCUIT
AAE48	1920-0054	INTEGRATED CIRCUIT
AAE49	1920-0054	INTEGRATED CIRCUIT
AAE50	1920-0054	INTEGRATED CIRCUIT
AAE51	1920-0054	INTEGRATED CIRCUIT
AAE52	1920-0054	INTEGRATED CIRCUIT
AAE53	1920-0054	INTEGRATED CIRCUIT
AAE54	1920-0054	INTEGRATED CIRCUIT
AAE55	1920-0054	INTEGRATED CIRCUIT
AAE56	1920-0054	INTEGRATED CIRCUIT
AAE57	1920-0054	INTEGRATED CIRCUIT
AAE58	1920-0054	INTEGRATED CIRCUIT
AAE59	1920-0054	INTEGRATED CIRCUIT
AAE60	1920-0054	INTEGRATED CIRCUIT
AAE61	1920-0054	INTEGRATED CIRCUIT
AAE62	1920-0054	INTEGRATED CIRCUIT
AAE63	1920-0054	INTEGRATED CIRCUIT
AAE64	1920-0054	INTEGRATED CIRCUIT
AAE65	1920-0054	INTEGRATED CIRCUIT
AAE66	1920-0054	INTEGRATED CIRCUIT
AAE67	1920-0054	INTEGRATED CIRCUIT
AAE68	1920-0054	INTEGRATED CIRCUIT
AAE69	1920-0054	INTEGRATED CIRCUIT
AAE70	1920-0054	INTEGRATED CIRCUIT
AAE71	1920-0054	INTEGRATED CIRCUIT
AAE72	1920-0054	INTEGRATED CIRCUIT
AAE73	1920-0054	INTEGRATED CIRCUIT
AAE74	1920-0054	INTEGRATED CIRCUIT
AAE75	1920-0054	INTEGRATED CIRCUIT
AAE76	1920-0054	INTEGRATED CIRCUIT
AAE77	1920-0054	INTEGRATED CIRCUIT
AAE78	1920-0054	INTEGRATED CIRCUIT
AAE79	1920-0054	INTEGRATED CIRCUIT
AAE80	1920-0054	INTEGRATED CIRCUIT
AAE81	1920-0054	INTEGRATED CIRCUIT
AAE82	1920-0054	INTEGRATED CIRCUIT
AAE83	1920-0054	INTEGRATED CIRCUIT
AAE84	1920-0054	INTEGRATED CIRCUIT
AAE85	1920-0054	INTEGRATED CIRCUIT
AAE86	1920-0054	INTEGRATED CIRCUIT
AAE87	1920-0054	INTEGRATED CIRCUIT
AAE88	1920-0054	INTEGRATED CIRCUIT
AAE89	1920-0054	INTEGRATED CIRCUIT
AAE90	1920-0054	INTEGRATED CIRCUIT
AAE91	1920-0054	INTEGRATED CIRCUIT
AAE92	1920-0054	INTEGRATED CIRCUIT
AAE93	1920-0054	INTEGRATED CIRCUIT
AAE94	1920-0054	INTEGRATED CIRCUIT
AAE95	1920-0054	INTEGRATED CIRCUIT
AAE96	1920-0054	INTEGRATED CIRCUIT
AAE97	1920-0054	INTEGRATED CIRCUIT
AAE98	1920-0054	INTEGRATED CIRCUIT
AAE99	1920-0054	INTEGRATED CIRCUIT
AAE100	1920-0054	INTEGRATED CIRCUIT

See Introduction to this section for ordering information

See introduction to this section for ordering information

For introduction to this section for ordering information

Reference Designation	Part No.	Description #
ARC29	1901-0040	DIODE/SILICON 10MA 10V
ARC30	1901-0025	DIODE/SILICON 100V 100MA
ARC31	1901-004C	DIODE/SILICON 10MA 10V
ARC32	1901-0025	DIODE/SILICON 100V 100MA
ARC33	1901-0040	DIODE/SILICON 10MA 10V
ARC34	1901-0025	DIODE/SILICON 100V 100MA
ARC35	1901-0040	DIODE/SILICON 10MA 10V
ARC36	1901-0025	DIODE/SILICON 100V 100MA
ARC37	1901-004C	DIODE/SILICON 10MA 10V
ARC38	1901-0025	DIODE/SILICON 100V 100MA
ARC39	1901-0040	DIODE/SILICON 10MA 10V
ARC40	1901-0025	DIODE/SILICON 100V 100MA
ARC41	1901-0051	DIODE STABISTOR
ARC42	1901-0051	DIODE STABISTOR
ARC43	1901-0051	DIODE STABISTOR
ARC44	1901-0051	DIODE STABISTOR
ARC45	1901-0051	DIODE STABISTOR
ARC46	1901-0051	DIODE STABISTOR
ARC1	1820-C117	INTEGRATED CIRCUIT
ARC2	1820-0110	INTEGRATED CIRCUIT
ARC3	1820-C093	CIRCUITIMP 3084-0008
ARC4	1820-C093	CIRCUITIMP 3084-0008
ARC5	1820-C093	CIRCUITIMP 3084-0008
ARC6	1820-C093	CIRCUITIMP 3084-0008
ARC1	1820-C093	CIRCUITIMP 3084-0008
ARC8	1820-C114	INTEGRATED CIRCUIT
ARC9	1820-C114	INTEGRATED CIRCUIT
ARC10	1820-C114	INTEGRATED CIRCUIT
ARC11	1820-C114	INTEGRATED CIRCUIT
ARC12	1820-C114	INTEGRATED CIRCUIT
ARC13	1820-C114	INTEGRATED CIRCUIT
ARC14	1820-C114	INTEGRATED CIRCUIT
ARC15	1820-C076	INTEGRATED CIRCUIT
ARC16	1820-C076	INTEGRATED CIRCUIT
ARC17	1820-C076	INTEGRATED CIRCUIT
ARC18	1820-C076	INTEGRATED CIRCUIT
ARC1	1954-CC11	TRANSISTOR/SILICON NPN
ARC2	1954-CC12	TRANSISTOR/SILICON NPN
ARC3	1954-CC11	TRANSISTOR/SILICON NPN
ARC4	1954-CC11	TRANSISTOR/SILICON NPN
ARC5	1954-CC11	TRANSISTOR/SILICON NPN
ARC6	1954-CC11	TRANSISTOR/SILICON NPN
ARC7	1954-CC11	TRANSISTOR/SILICON NPN
ARC8	1954-CC12	TRANSISTOR/SILICON NPN
ARC9	1954-CC11	TRANSISTOR/SILICON NPN
ARC10	1954-CC11	TRANSISTOR/SILICON NPN
ARC11	1954-CC11	TRANSISTOR/SILICON NPN
ARC12	1954-CC11	TRANSISTOR/SILICON NPN
ARC13	1954-CC15	TRANSISTOR/SILICON PNP 2N3640
ARC14	1954-CC11	TRANSISTOR/SILICON NPN
ARC15	1954-CC11	TRANSISTOR/SILICON NPN
ARC16	1954-CC11	TRANSISTOR/SILICON NPN
ARC17	1954-CC11	TRANSISTOR/SILICON NPN
ARC18	1954-CC11	TRANSISTOR/SILICON NPN
ARC19	1954-CC11	TRANSISTOR/SILICON NPN
ARC20	1954-CC11	TRANSISTOR/SILICON NPN
ARC21	1954-CC11	TRANSISTOR/SILICON NPN

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Reference Designation	Part No.	Description #
ARC22	1954-CC15	TRANSISTOR/SILICON NPN 2N109
ARC23	1954-CC15	TRANSISTOR/SILICON NPN 2N109
ARC24	1954-CC15	TRANSISTOR/SILICON NPN 2N109
ARC25	1954-CC15	TRANSISTOR/SILICON NPN 2N109
ARC26	1954-CC11	TRANSISTOR/SILICON NPN
ARC27	1954-CC11	TRANSISTOR/SILICON NPN
ARC28	1954-CC11	TRANSISTOR/SILICON NPN
ARC29	1954-CC11	TRANSISTOR/SILICON NPN
ARC30	1954-CC11	TRANSISTOR/SILICON NPN
ARC31	1954-CC11	TRANSISTOR/SILICON NPN
ARC32	1954-CC11	TRANSISTOR/SILICON NPN
ARC33	1954-CC11	TRANSISTOR/SILICON NPN
ARC34	1954-CC11	TRANSISTOR/SILICON NPN
ARC35	1954-CC11	TRANSISTOR/SILICON NPN
ARC36	1954-CC11	TRANSISTOR/SILICON NPN
ARC37	1954-CC11	TRANSISTOR/SILICON NPN
ARC38	1954-CC11	TRANSISTOR/SILICON NPN
ARC39	1954-CC11	TRANSISTOR/SILICON NPN
ARC40	1954-CC11	TRANSISTOR/SILICON NPN
ARC41	1954-CC11	TRANSISTOR/SILICON NPN
ARC42	1954-CC11	TRANSISTOR/SILICON NPN
ARC43	1954-CC11	TRANSISTOR/SILICON NPN
ARC44	1954-CC11	TRANSISTOR/SILICON NPN
ARC45	1954-CC11	TRANSISTOR/SILICON NPN
ARC46	1954-CC11	TRANSISTOR/SILICON NPN
ARC47	1954-CC11	TRANSISTOR/SILICON NPN
ARC48	1954-CC11	TRANSISTOR/SILICON NPN
ARC49	1954-CC11	TRANSISTOR/SILICON NPN
ARC50	1954-CC11	TRANSISTOR/SILICON NPN
ARC51	1954-CC11	TRANSISTOR/SILICON NPN
ARC52	1954-CC11	TRANSISTOR/SILICON NPN
ARC53	1954-CC11	TRANSISTOR/SILICON NPN
ARC54	1954-CC11	TRANSISTOR/SILICON NPN
ARC55	1954-CC11	TRANSISTOR/SILICON NPN
ARC56	1954-CC11	TRANSISTOR/SILICON NPN
ARC57	1954-CC11	TRANSISTOR/SILICON NPN
ARC58	1954-CC11	TRANSISTOR/SILICON NPN
ARC59	1954-CC11	TRANSISTOR/SILICON NPN
ARC60	1954-CC11	TRANSISTOR/SILICON NPN
ARC61	1954-CC11	TRANSISTOR/SILICON NPN
ARC62	1954-CC11	TRANSISTOR/SILICON NPN
ARC63	1954-CC11	TRANSISTOR/SILICON NPN
ARC64	1954-CC11	TRANSISTOR/SILICON NPN
ARC65	1954-CC11	TRANSISTOR/SILICON NPN
ARC66	1954-CC11	TRANSISTOR/SILICON NPN
ARC67	1954-CC11	TRANSISTOR/SILICON NPN
ARC68	1954-CC11	TRANSISTOR/SILICON NPN
ARC69	1954-CC11	TRANSISTOR/SILICON NPN
ARC70	1954-CC11	TRANSISTOR/SILICON NPN
ARC71	1954-CC11	TRANSISTOR/SILICON NPN
ARC72	1954-CC11	TRANSISTOR/SILICON NPN
ARC73	1954-CC11	TRANSISTOR/SILICON NPN
ARC74	1954-CC11	TRANSISTOR/SILICON NPN
ARC75	1954-CC11	TRANSISTOR/SILICON NPN
ARC76	1954-CC11	TRANSISTOR/SILICON NPN
ARC77	1954-CC11	TRANSISTOR/SILICON NPN
ARC78	1954-CC11	TRANSISTOR/SILICON NPN
ARC79	1954-CC11	TRANSISTOR/SILICON NPN
ARC80	1954-CC11	TRANSISTOR/SILICON NPN
ARC81	1954-CC11	TRANSISTOR/SILICON NPN
ARC82	1954-CC11	TRANSISTOR/SILICON NPN
ARC83	1954-CC11	TRANSISTOR/SILICON NPN
ARC84	1954-CC11	TRANSISTOR/SILICON NPN
ARC85	1954-CC11	TRANSISTOR/SILICON NPN
ARC86	1954-CC11	TRANSISTOR/SILICON NPN
ARC87	1954-CC11	TRANSISTOR/SILICON NPN
ARC88	1954-CC11	TRANSISTOR/SILICON NPN
ARC89	1954-CC11	TRANSISTOR/SILICON NPN
ARC90	1954-CC11	TRANSISTOR/SILICON NPN
ARC91	1954-CC11	TRANSISTOR/SILICON NPN
ARC92	1954-CC11	TRANSISTOR/SILICON NPN
ARC93	1954-CC11	TRANSISTOR/SILICON NPN
ARC94	1954-CC11	TRANSISTOR/SILICON NPN
ARC95	1954-CC11	TRANSISTOR/SILICON NPN
ARC96	1954-CC11	TRANSISTOR/SILICON NPN
ARC97	1954-CC11	TRANSISTOR/SILICON NPN
ARC98	1954-CC11	TRANSISTOR/SILICON NPN
ARC99	1954-CC11	TRANSISTOR/SILICON NPN
ARC100	1954-CC11	TRANSISTOR/SILICON NPN

See Introduction to this section for ordering information

Section VII
Options and Manual Changes

Table 7-8. 05325-60007 Counter Board Parts (Continued)

Model 5325B

Reference Designation	Part No.	Description #
AYCP1	1901-0025	DIODE SILICON 100W 100MA
AYCP2	1901-0025	DIODE SILICON 100W 100MA
AYCP3	1901-0025	DIODE SILICON 100W 100MA
AYCP4	1901-0025	DIODE SILICON 100W 100MA
AYCP5	1901-0025	DIODE SILICON 100W 100MA
AYCP6	1901-0025	DIODE SILICON 100W 100MA
AYCP7	1901-0025	DIODE SILICON 100W 100MA
AYC H	1907-C197	DIODE BREAKDOWN SILICON 82.5V 5A
AYCH5	1907-C197	DIODE BREAKDOWN SILICON 82.5V 5A

See introduction to this section for ordering information

Table 7-11. 05325-60039 Power Supply Board

Reference Designation	Part No.	Description #
ATT	05325 60039	POWER SUPPLY BOARD
ATT1C1	0180 2152	C FAD ELECT 50V -10-50% 20VDCW
ATT1C2	0180 2154	C FAD ELECT 100V OF -10-75 15VDCW
ATT1C3	0180 0210	C FAD TANT 3.3 UF 20% 15VDCW
ATT1C4	0100 2228	C FAD MICA 2200 PF 2% 200VDCW
ATT1R1	0583 1045	R FAD COMP 100K OHM 5% 1/4W
ATT1R2	0583 7515	R FAD COMP 750 OHM 5% 1/4W
ATT1R3	0583 5136	R FAD COMP 51K OHM 5% 1/4W
ATT1R4	0583 7415	R FAD COMP 740 OHM 5% 1/4W
ATT1Q1	1853 0020	TRANSISTOR PNP
ATT1Q2	1854 0222	TRANSISTOR NPN
ATT1CR1	1901 0028	DIODE SIL 75A 4G PIV
ATT1CR2	1901 0028	DIODE SIL 75A 400V
ATT1CR3	1901 0028	DIODE SIL 75A 400PIV
ATT1CR4	1901 0028	DIODE SIL 75A 400PIV
ATT1CR5	1901 0200	DIODE SIL 3A 100 PIV
ATT1CR6	1901 0200	DIODE SIL 3A 100 P V
ATT1CR7	1901 0200	DIODE SIL 3A 100 PIV
ATT1CR8	1901 0200	DIODE SIL 3A 100 PIV
ATT1CR9	1901 0040	DIODE SIL
ATT1CR10	1902 3094	DIODE BREAKDOWN 511V
ATT1CR11	1902 3429	DIODE BREAKDOWN 100V
ATT1CR12	1902 3394	DIODE BREAKDOWN 75V
ATT1CR13	1902 3136	DIODE BREAKDOWN 525V
	05325 20038	BOARD PC BLANK

See introduction to this section for ordering information

Table 7-10. 05325-60006 Power Supply No. 2 Parts

Table 7-12. Oscillator Multiplier (05325-50008)

Reference Designator	HP Part No	Description #
A7R1	0624 0695	R FLD CARBON 2.2K OHM 5% 1/8W
A7R2	0608 6001	R FLD COMP 10K OHM 5% 1/8W
A7R3	0608 3315	R FLD COMP 43 OHM 5% 1/8W
A7R4	0608 5180	R FLD COMP 2K OHM 5% 1/8W
A7R5	0608 6000	R FLD COMP 2.2K OHM 5% 1/8W
A7R6	2101-1760	H VAR WW 5K OHM 10% LIN 1/2W
A7R7	0608 3381	R FLD COMP 150 OHM 5% 1/8W
A7R8	0608 6067	R FLD CARBON 27K OHM 5% 1/8W
A7R9	0608 6000	R FLD COMP 10K OHM 5% 1/8W
A7R10	0608 6000	R FLD COMP 2K OHM 5% 1/8W
A7R11	0608 6001	R FLD COMP 12K OHM 5% 1/8W
A7R12	0608 6000	R FLD COMP 2.2K OHM 5% 1/8W
A7R13	0608 6123	R FLD COMP 20K OHM 5% 1/8W
A7R14	0608 6123	R FLD COMP 120K OHM 5% 1/8W
A7R15	0608 6100	R FLD COMP 2K OHM 5% 1/8W
A7R16	0608 6067	R FLD COMP 12K OHM 5% 1/8W
A7R17	0608 6066	R FLD CARBON 2.2K OHM 5% 1/8W
A7R18	0608 6066	R FLD CARBON 2.2K OHM 5% 1/8W
A7R19	0608 3113	R FLD CARBON 100 OHM 5% 1/8W
A7R20	0608 6001	R FLD COMP 10K OHM 5% 1/8W
A7R21	0608 6066	R FLD CARBON 2.2K OHM 5% 1/8W
A7R22	0608 3114	R FLD COMP 330 OHM 5% 1/8W
A7R23	0608 6101	R FLD COMP 430 OHM 5% 1/8W
A7R24	0608 3118	R FLD CARBON 11 OHM 5% 1/8W
A7R25	0608 3114	R FLD COMP 300 OHM 5% 1/8W
A7R26	0608 6000	R FLD COMP 500 OHM 5% 1/8W
A7R27	0608 6183	R FLD COMP 4.3K OHM 5% 1/8W
A7R28	0608 6066	R FLD COMP 2.2K OHM 5% 1/8W
A7R29	0608 6174	R FLD COMP 200 OHM 5% 1/8W
A7R30	0608 6172	R FLD COMP 1.1 OHM 1% 1/8W
A7R31	100K-6174	R FLD COMP 200 OHM 5% 1/8W
A7R32	0608 3381	R FLD COMP 150 OHM 5% 1/8W

* See introduction to this section for ordering information

Reference Designator	HP Part No	Description #
A7	06375 6008 06375 2000R	ASSY OSCILLATOR MULTI POINT 5 BOARD BLANK PC
A7C1	0170 0985	C FLD MY 0.01F 20% 16VDCW
A7C2	0180 0210	C FLD ELECT 33UF 20% 16VDCW
A7C3	0160 0960	C FLD CTR 100PF 50VDCW
A7C4	0160 0766	C FLD MICA 18 PF 5% 300VDCW
A7C5	0121 0960	C VAR CER 2.8 PF 300VDCW
A7C6	0140 0177	C FLD MICA 400 PF 1% 300VDCW
A7C7	0140 0208	C FLD MICA 800 PF 5% 300VDCW
A7C8	0160 2056	C FLD CER 901 UF +80-20% 10VDCW
A7C9	0160 2056	C FLD CER 901 UF +80-20% 10VDCW
A7C10	0160 2056	C FLD CER 901 UF +80-20% 10VDCW
A7C11	0160 2218	C FLD MICA 1000 PF 5% 300VDCW
A7C12	0160 2056	C FLD CER 0.01 UF +80-20% 10VDCW
A7C13	0140 0192	C FLD MICA 68 PF 5% 300VDCW
A7C14	0160 0194	C FLD MY 0.01F UF 10%
A7C15	0140 0166	C FLD MICA 12 PF 5% 300VDCW
A7C16	0140 0182	C FLD MICA 6000 PF 2% 300VDCW
A7C17	0140 0199	C FLD MICA 240 PF 5% 300VDCW
A7C18	0160 2056	C FLD CER 0.01 UF +80-20% 10VDCW
A7C19	0140 0299	C FLD MICA 50 PF 10% 500VDCW
A7C20	0160 0254	C FLD MY 0.01F UF 10% 300VDCW
A7C21	0140 0196	C FLD MICA 240 PF 5% 300VDCW
A7C22	0140 0200	C FLD MICA 300 PF 5% 300VDCW
A7C23	0180 0210	C FLD ELECT 33 UF 20% 16VDCW
A7C24	0160 2199	C FLD MICA 30 PF 5% 300VDCW
A7CR1	1819 0022	DIODE GERMANIUM 6 WIV
A7L1	0140 0150	COIL FLD RF 1 OHM 10%
A7L2	0140 0176	COIL VAR 1.7F 500 MH
A7L3	0140 0176	COIL VAR 1.7F 400 MH
A7L4	0140 0175	COIL VAR 0.9-1.8 OHM
A7L5	0140 0175	COIL VAR 0.9-1.8 OHM
A7L6	0140 0160	COIL FLD RF 1 OHM 10%
A7O1	1854 0010	Q SI NPN SELECTED FROM 2N2368
A7O2	1854 0071	Q SI NPN SELECTED FROM 2N3704
A7O3	1854 0071	Q SI NPN SELECTED FROM 2N3704
A7O4	1854 0071	Q SI NPN SELECTED FROM 2N3704
A7O5	1853 0036	Q SI PNP
A7O6	1853 0036	Q SI PNP
A7O7	1854 0006	Q SI NPN
A7O8	1854 0000	Q SI NPN
A7O9	1854 0000	Q SI NPN

* See introduction to this section for ordering information

Section VII
Options and Manual Changes

Table 7-13. Oscillator Multi Board (05325-60049) Series 1044A

Reference Designator	HP Part No.	Description #
A7	06325 60049 06326 20049	ASSY OSCILLATOR MULTI BOARD SERIES 1044A BOARD BLANK PC
A7C1	0121 0060	C VAR CER DISK 2 8 PF
A7C2	0160 2261	C F XD CER 16 PF 5% 600VDCW
A7C3	0160 206A	C F XD CER 01 UF -20 +80% 100VDCW
A7C4	0160 0181	C F XD MY 01 UF 10% 200VDCW
A7C5	0180 0197	C F XD TANT 22 PF 10% 20VDCW
A7C6	0160 0076	C F XD CER 0047 UF +100 20% 600VDCW
A7C7	0160 2306	C F XD MICA 27 PF 5% 300VDCW
A7C8	0160 0076	C F XD CER 0047 UF +100 20% 600VDCW
A7CR1	1810 0034	DIODE GER 100 MA
A7CR2	1907 3139	DIODE BRKDN 8 25V
A7L1	9100 2278	COIL 100 UH
A7Q1	1864 0030	TRANSISTOR 2N700
A7Q2	1860 0168	TRANSISTOR 2N2636
A7Q3	1864 0030	TRANSISTOR 2N700
A7R1	0683 4037	R F XD FILM 46.4 OHM 1/8W
A7R2	0683 1026	R F XD COMP 1000 OHM 1/4W
A7R3	0683 1026	R F XD FILM 46.4 OHM 1/8W
A7R4	0683 1036	R F XD COMP 10K OHM 1/4W
A7R5	0683 1026	R F XD COMP 1000 OHM 1/4W
A7R6	0683 7536	R F XD COMP 7500 OHM 1/4W
A7R7	0683 1536	R F XD COMP 15K OHM 1/4W
A7R8	0683 1026	R F XD COMP 1000 OHM 1/4W
A7R9	0683 2006	R F XD COMP 20 OHM 1/4W
A7R10	0683 4316	R F XD COMP 430 OHM 1/4W
A7R11	0683 4716	R F XD COMP 470 OHM 1/4W
A7R12	0683 4716	R F XD COMP 470 OHM 1/4W
A7R13	0683 6106	R F XD COMP 61 OHM 1/4W
A7U1	1820 0142	CIRCUIT INTEGRATED
A7U2	1820 0064	CIRCUIT INTEGRATED

See introduction to this section for ordering information

Table 7-14. Oscillator Multi Board (05325-60049) Series 1112

Reference Designator	HP Part No.	Description #
A7	06325 60049 06326 20049	ASSY OSCILLATOR MULTI BOARD SERIES 1112 BOARD BLANK PC
A7C1	0121 0060	C VAR CER DISK 2 8 PF
A7C2	0160 2261	C F XD CER 16 PF 5% 600VDCW
A7C3	0160 206A	C F XD CER 01 UF 20% 100VDCW
A7C4	0160 0181	C F XD MY 01 UF 10% 200VDCW
A7C5	0180 0197	C F XD TANT 22 PF 10% 20VDCW
A7C6	0160 0076	C F XD CER 0047 UF +100 20% 600VDCW
A7C7	0160 2306	C F XD MICA 27 PF 5% 300VDCW
A7C8	0160 0076	C F XD CER 0047 UF +100 20% 600VDCW
A7CR1	1810 0034	DIODE GER 100 MA
A7CR2	1907 3139	DIODE BRKDN 8 25V
A7L1	9100 2278	COIL 100 UH
A7Q1	1864 0030	TRANSISTOR 2N700
A7Q2	1860 0168	TRANSISTOR 2N2636
A7Q3	1864 0030	TRANSISTOR 2N700
A7R1	0796 4037	R F XD FILM 46.4 OHM 1/8W
A7R2	0683 1026	R F XD COMP 1000 OHM 1/4W
A7R3	0683 1026	R F XD COMP 1000 OHM 1/4W
A7R4	0683 1036	R F XD COMP 10K OHM 1/4W
A7R5	0683 1026	R F XD COMP 1000 OHM 1/4W
A7R6	0683 7536	R F XD COMP 7500 OHM 1/4W
A7R7	0683 1536	R F XD COMP 15K OHM 1/4W
A7R8	0683 1026	R F XD COMP 1000 OHM 1/4W
A7R9	0683 2006	R F XD COMP 20 OHM 1/4W
A7R10	0683 4316	R F XD COMP 430 OHM 1/4W
A7R11	0683 4716	R F XD COMP 470 OHM 1/4W
A7R12	0683 4716	R F XD COMP 470 OHM 1/4W
A7R13	0683 6106	R F XD COMP 61 OHM 1/4W
A7U1	1820 0142	CIRCUIT INTEGRATED
A7U2	1820 0064	CIRCUIT INTEGRATED

See introduction to this section for ordering information

Table 7-15. Connections to REMOTE PROGRAM Connector J8

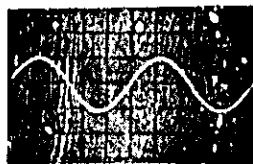
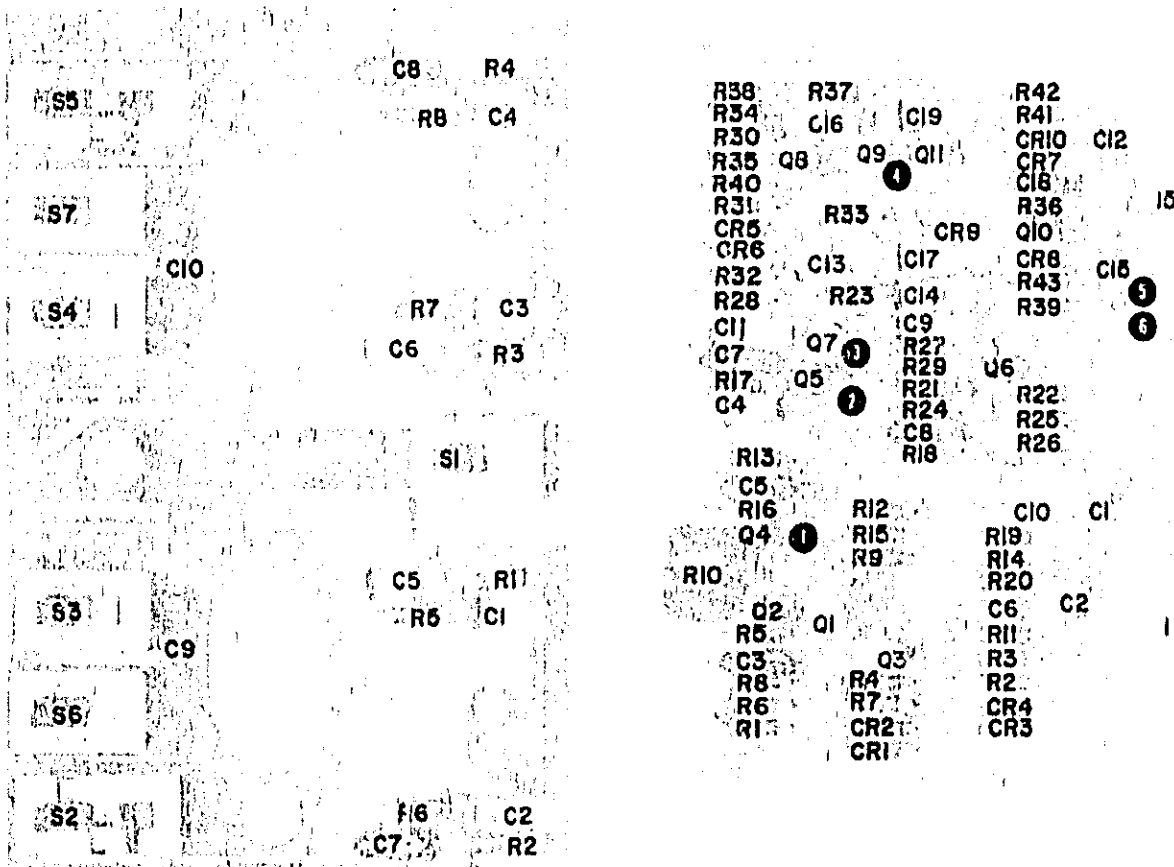
FUNCTION	CONTROL CURRENT MAX (mA)	PIN NO.	WIRE COLOR	CONNECTS TO	REMARKS
CHANNEL A					
X100	15	8	WHT-BLU	A1	Note 1
X10	15	9	WHT-GRN	A1	Note 1
AC-DC	15	7	WHT	A1	Note 2
CHANNEL B					
X100	15	12	WHT-BLK	A1	Note 1
X10	15	31	WHT-GY	A1	Note 1
AC-DC	15	10	WHT-BRN	A1	Note 2
<p>Note 1: With no program input, attenuator is in X1 mode. Floating potential is +12 V with control line open.</p> <p>Note 2: With no program input, coupling is AC. Floating potential is +12 V with control line open.</p>					

Table 7-16. Option 01 05325-60033 Attenuator Parts List

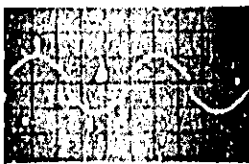
REFERENCE DESIGNATION	DESCRIPTION	HP PART NO.
Option 01	Remote Attenuator Board	05325-60033
C1	Capacitor: Fxd, cer, 5 pF, 5%, 500 vdew	0160-0743
C2	Capacitor: Fxd, mica, 33 pF, 5%, 300 vdew	0160-2150
C3	Capacitor: Fxd, mica, 600 pF, 1%, 300 vdew	0160-0340
C4	Capacitor: Fxd, cer, 5 pF, 5%, 500 vdew	0160-0748
C5	Capacitor: Fxd, mica, 33 pF, 5%, 300 vdew	0160-2150
C6	Capacitor: Fxd, mica, 600 pF, 1%, 300 vdew	0610-0340
C7, C8	Capacitor: Fxd, mylar, .033 μ F, 10%	0610-0163
K1-K4	Relay, Attenuator	0490-0393
K5, K6	Relay, AC-DC	0490-0399
R1	Resistor: Fxd, comp, 1M ohm 5%, 1/4W	0683-1055
R2	Resistor: Fxd, comp, 100K ohm 5%, 1/4W	0683-1045
R3	Resistor: Fxd, comp, 10K ohm 5%, 1/4W	0683-1035
R4	Resistor: Fxd, comp, 1M ohm 5%, 1/4W	0683-1055
R5	Resistor: Fxd, comp, 10K ohm 5%, 1/4W	0683-1035
R6	Resistor: Fxd, comp, 10K ohm 5%, 1/4W	0683-1035
S1	Switch, slide: DPDT	3101-1311
S2	Switch, slide: DP3T	3101-1313
S3, S4	Switch, slide: DPDT	3101-1311
S5	Switch, slide: DP3T	3101-1313
S6	Switch, slide: DPDT	3101-1311
--	Blank Board	05325-20017

The block diagram illustrates the architecture of the 100 Watt CW Transmitter, Model 1000. It begins with two power supply units: a 0-10V DC POWER SUPPLY (NO. 1, 100115-00001) and a 0-10V AC POWER SUPPLY (NO. 2, 100115-00001). These feed into a 0-10V STEADY STATE (NO. 3, 100115-00001) and a 0-10V OSCILLATOR/AMPLIFIER (NO. 4, 100115-00001). The oscillator/amplifier output is connected to a 0-10V ATTENUATOR (NO. 5, 100115-00001). The attenuator's output is then sent to a 0-10V AMPLIFIER (NO. 6, 100115-00001). The amplifier's output is connected to a 0-10V OSCILLATOR (NO. 7, 100115-00001). The oscillator's output is connected to a 0-10V COUNTER (NO. 8, 100115-00001). The counter's output is connected to a 0-10V ANTENNA (NO. 9, 100115-00001). The diagram also shows various control and monitoring points, including a 0-10V ATTENUATOR (NO. 10, 100115-00001) and a 0-10V OSCILLATOR (NO. 11, 100115-00001). The entire system is powered by a 0-10V DC POWER SUPPLY (NO. 12, 100115-00001) and a 0-10V AC POWER SUPPLY (NO. 13, 100115-00001).

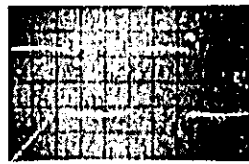
Figure 7-4. 5325/60009-60001 A1-A2 Input Attenuator and Amplifier Trigger Parts Locations



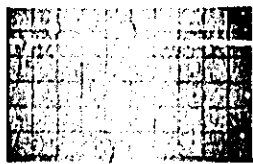
1



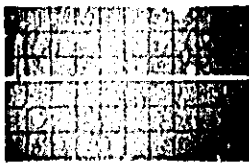
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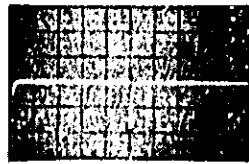
3



4



5



6

Figure 7-5. 05325/60009-60001 A1/A2 Input Attenuator and Amplifier-Trigger Schematic

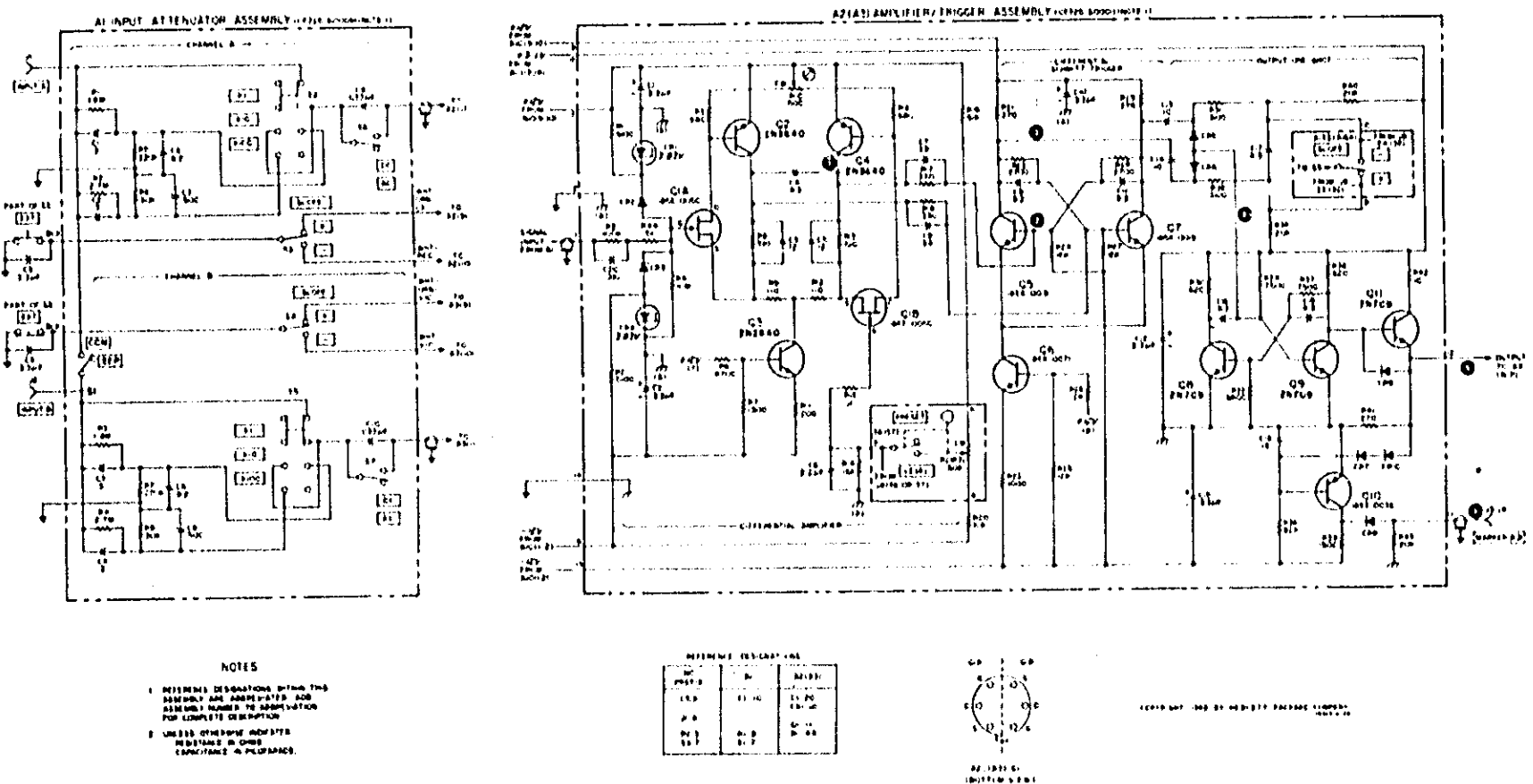
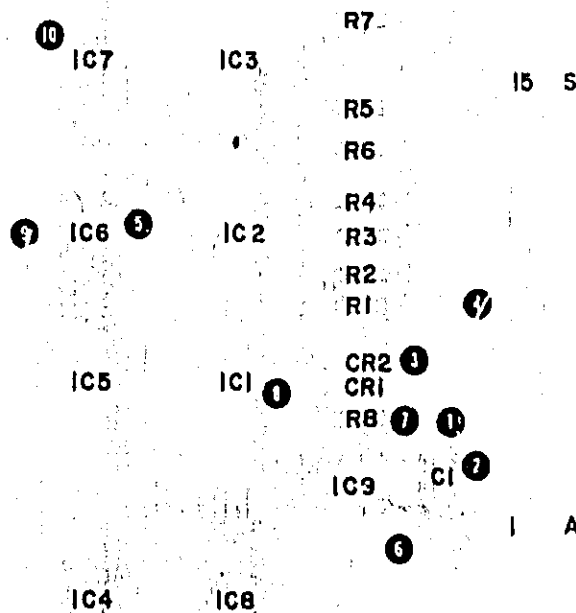


Figure 7-6. 05325-60003 A4 Function Selector Parts Locations



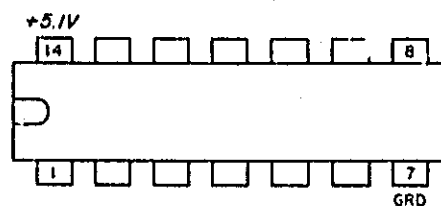
NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
RESISTANCE IN OHMS;
CAPACITANCE IN PICOFARADS;
3. SWITCH SHOWN IN CHECK
4. THIS CONTACT (ON EACH SWITCH SECTION) MAKES MOMENTARY CONTACT WHEN A BOTTOM IS PRESSED, TO RESET COUNTER

REFERENCE DESIGNATIONS

NO PREFIX	A4
	C1 CR1,2 IC1-9
J6,7	
S5	R1-8

A4IC1-9
(TOP VIEW)

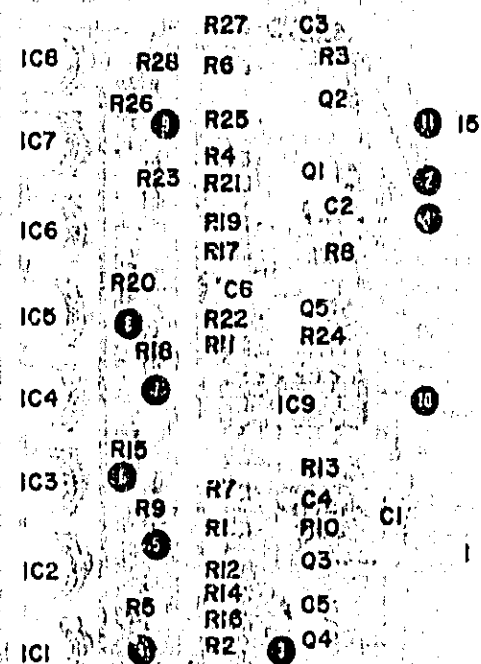


05325-D-3

Section VII Final Changes



Figure 7-8. 05325-00004 A5 Time Base Parts Location



1



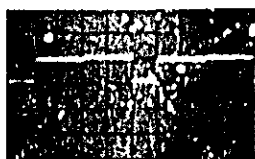
2



3



4



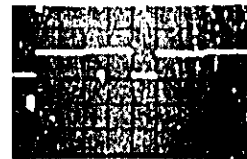
5



6



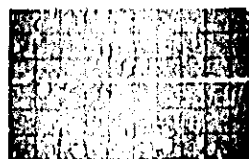
7



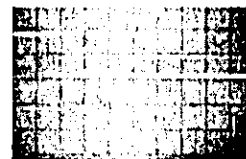
8



9



10



11

Figure 7-9. 05325-60004 A5 Time Base Schematic

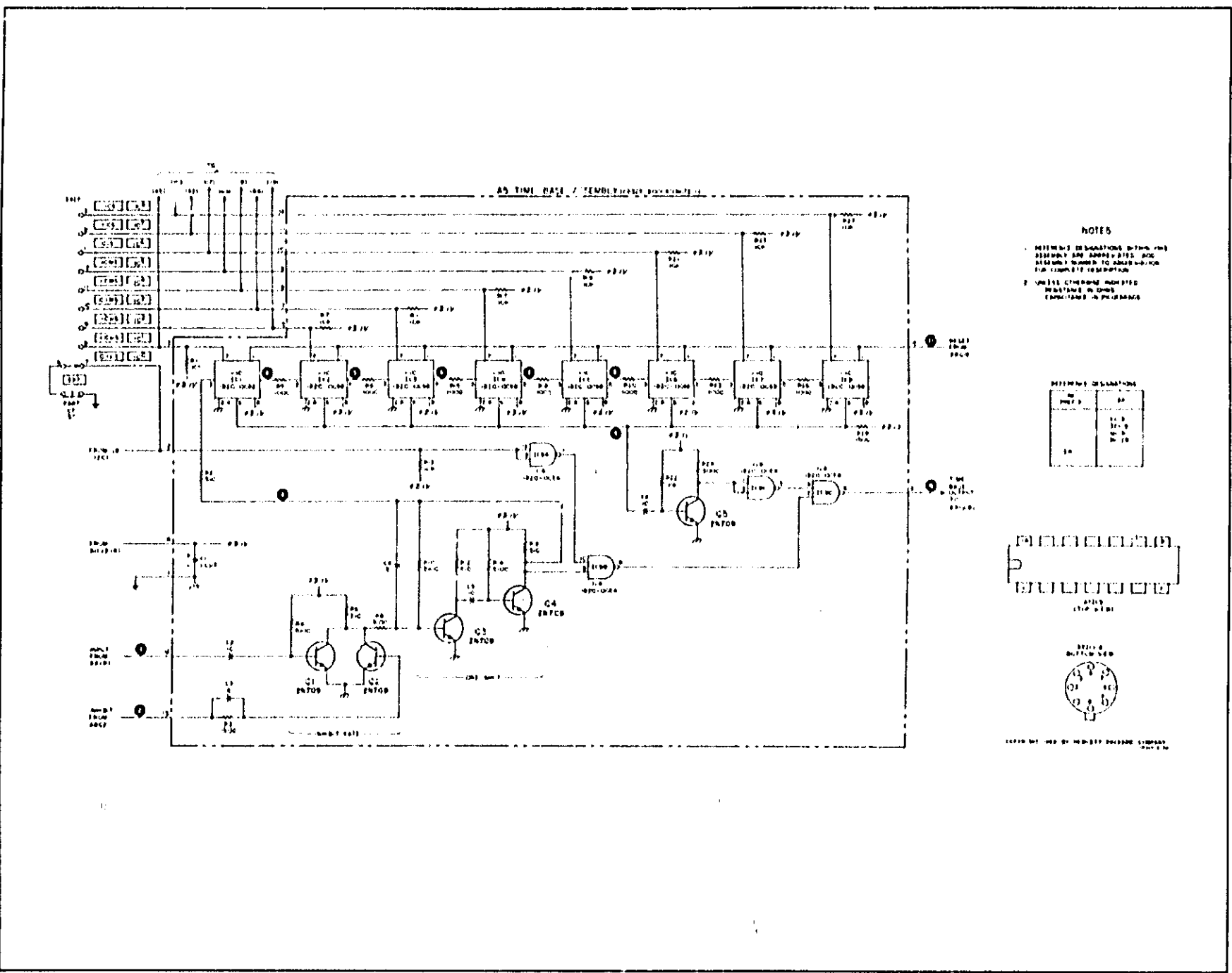


Figure 7-10. 05325-60007 A8 Counter Board Parts Location

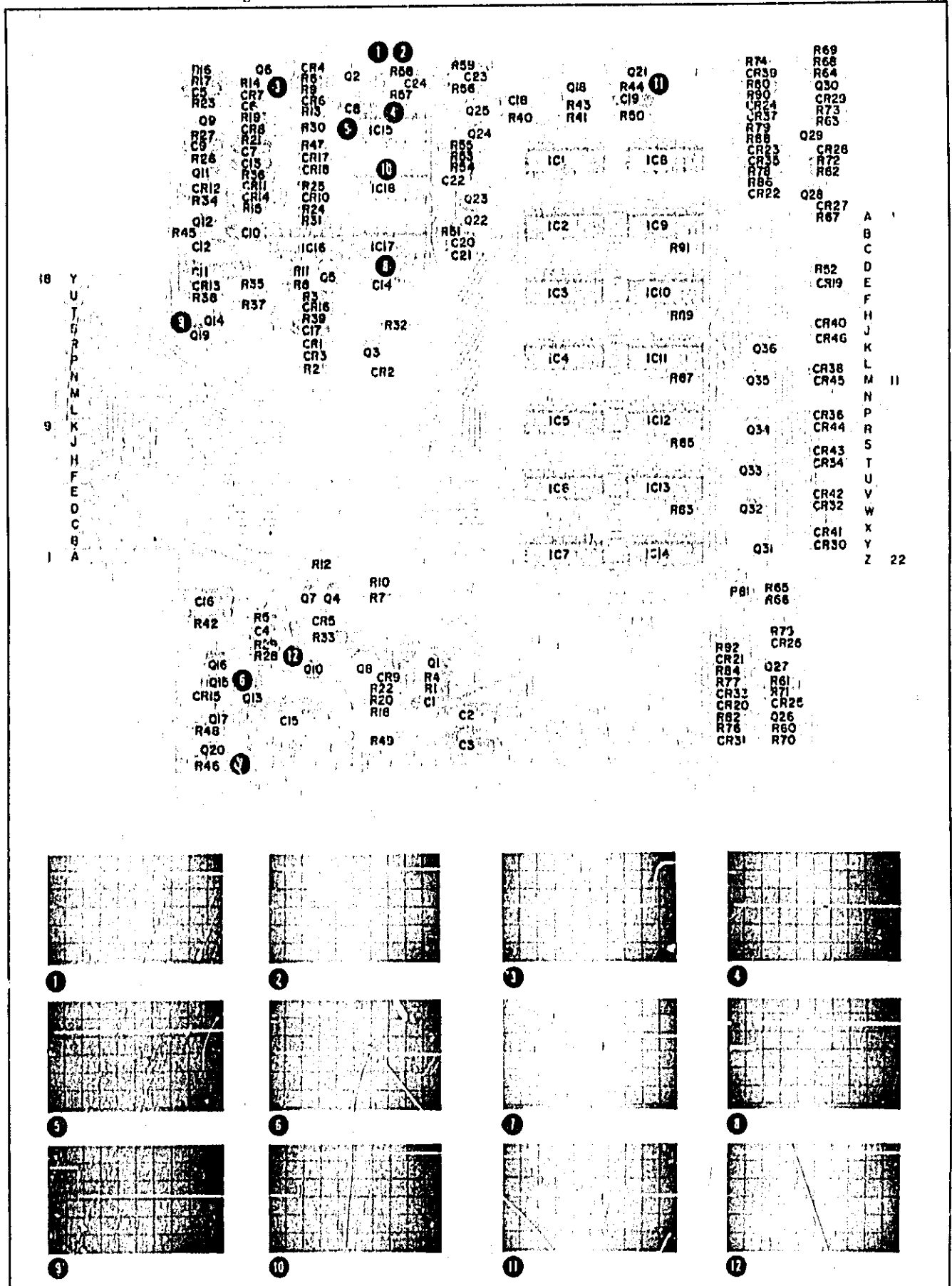


Figure 7-11. 05325-60007 A8 Counter Board Schematic (Sheet 1 of 2)

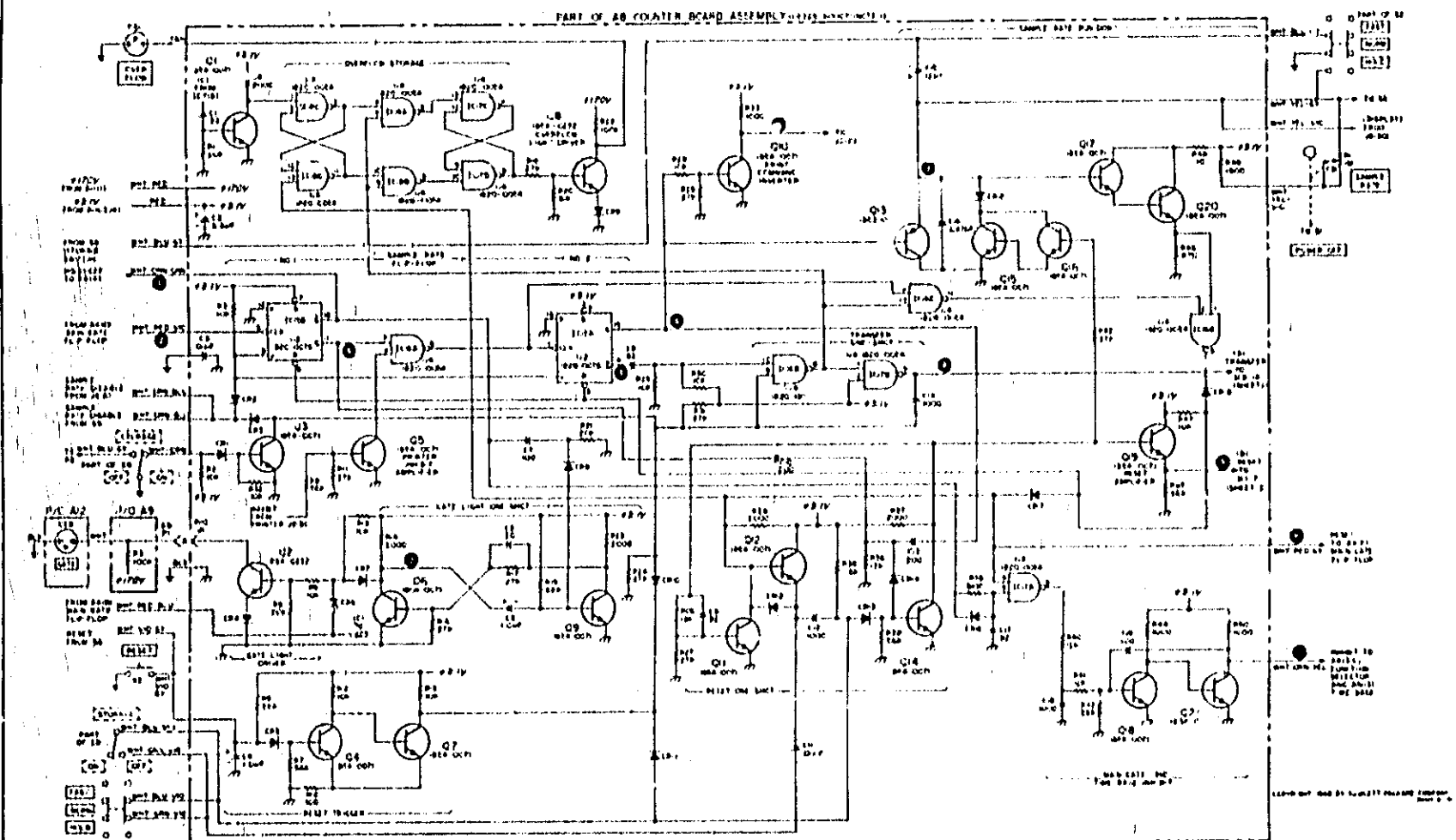


Figure 7-10 Repeated. 05325-00007 AB Counter Board Parts Location

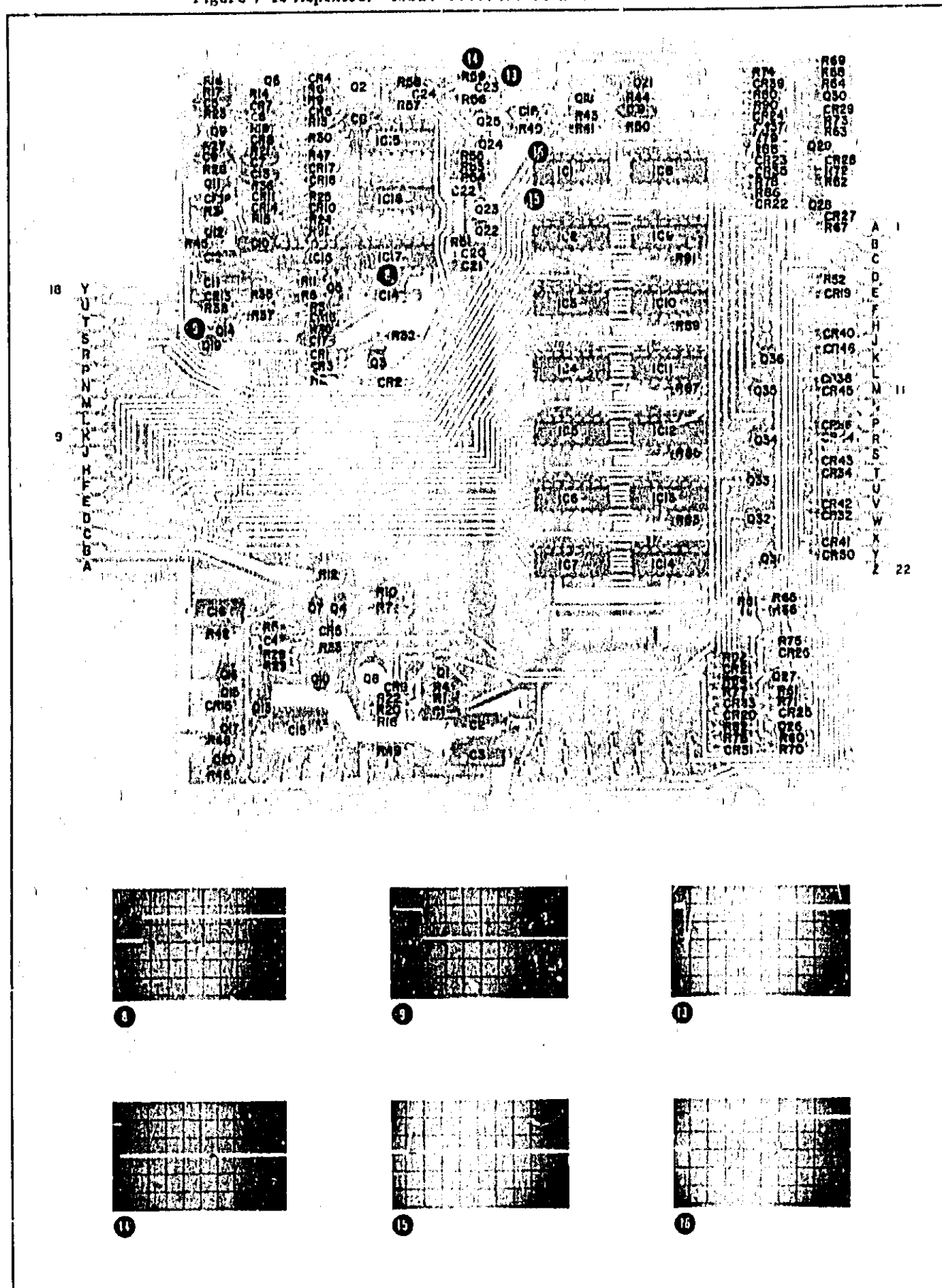


Figure 7-12. 05325-60011-60010 A0-A12 Display-Annunciator Parts Location

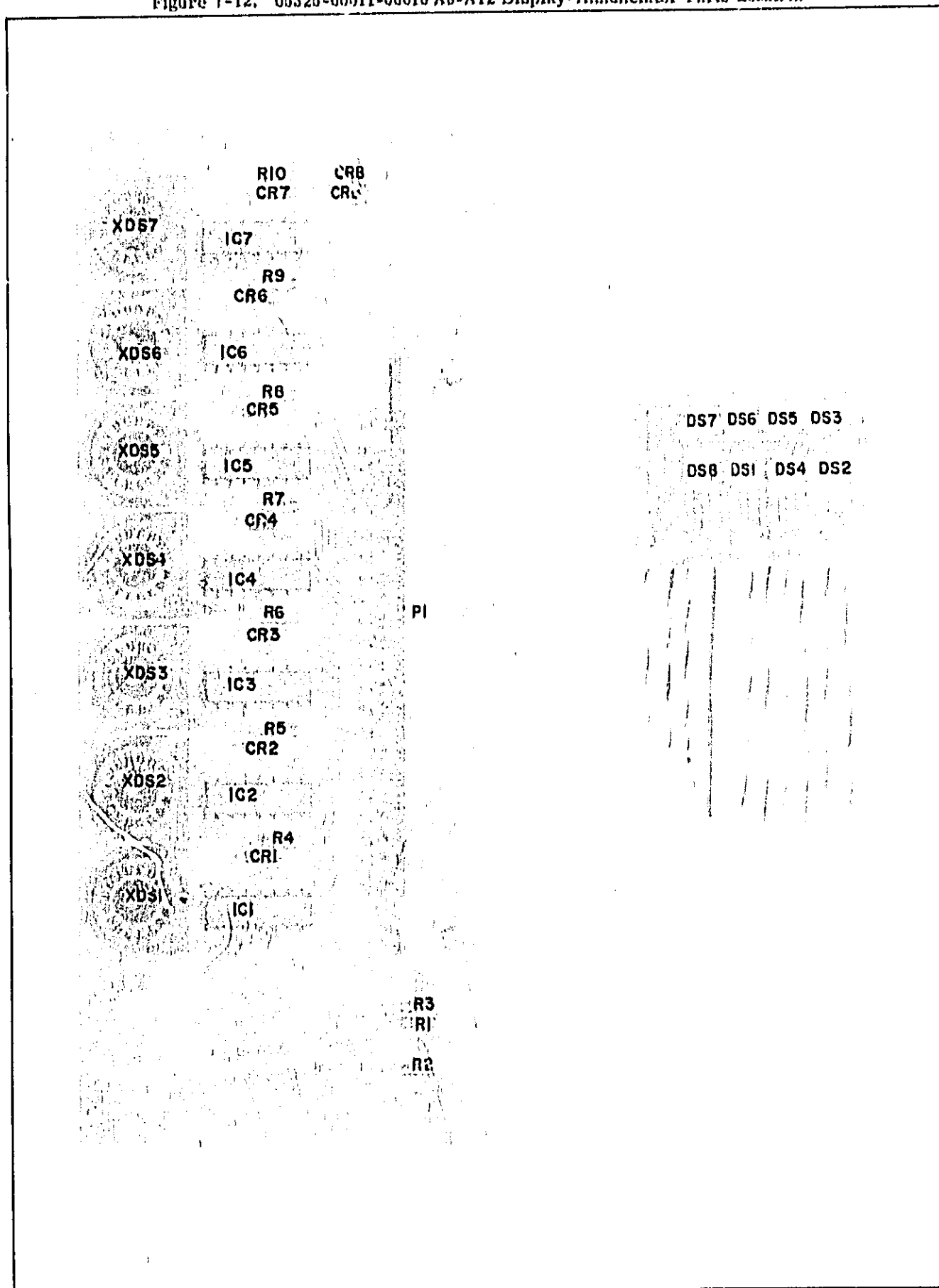
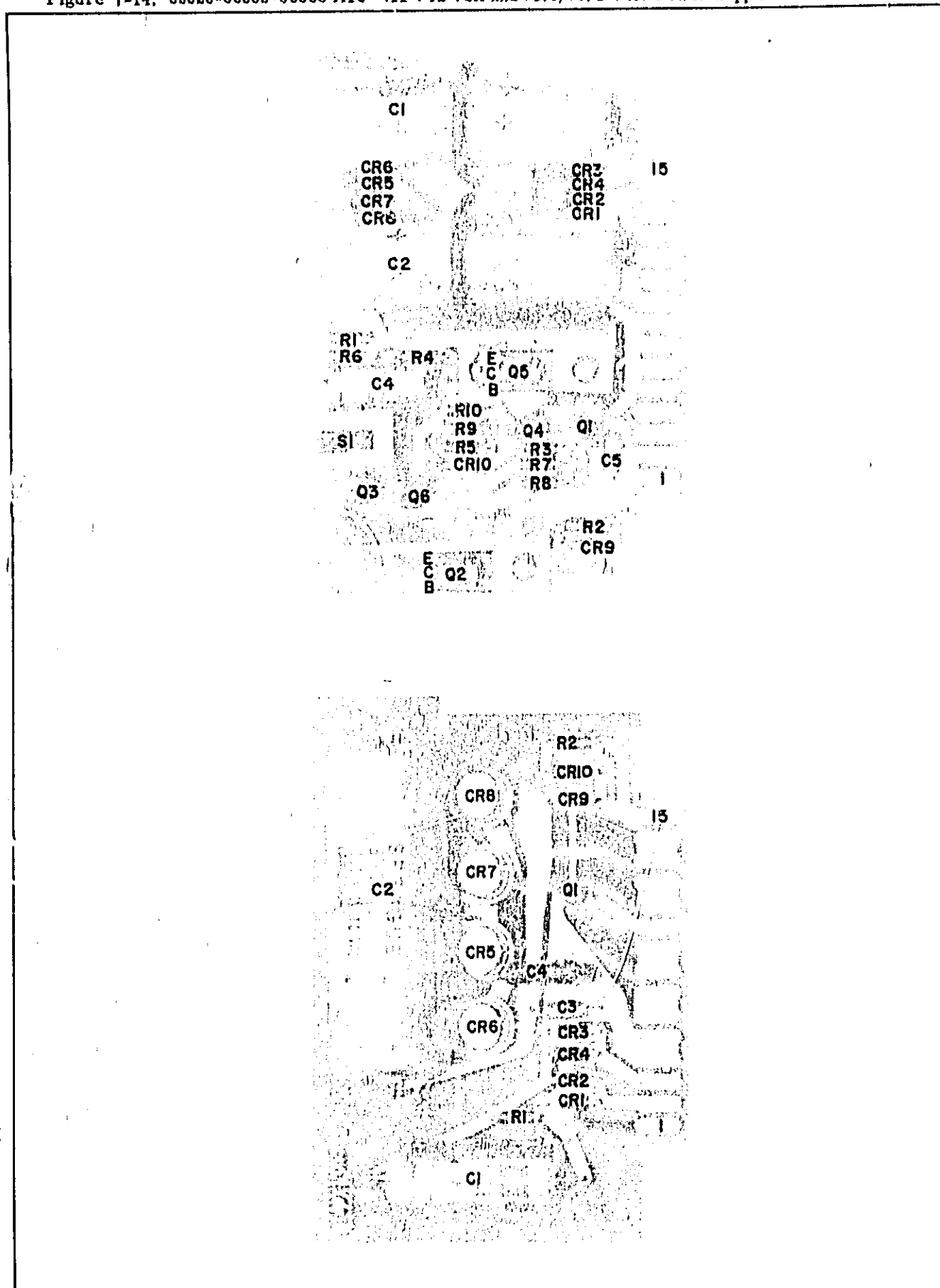


Figure 7-14. 05325-60005-60006 A10-7.11 +12 Volt and +170/+5.1 Volt Power Supplies Parts Locations



1170 AND 1171 VOLT MAINLY ASSEMBLY

NOTES:

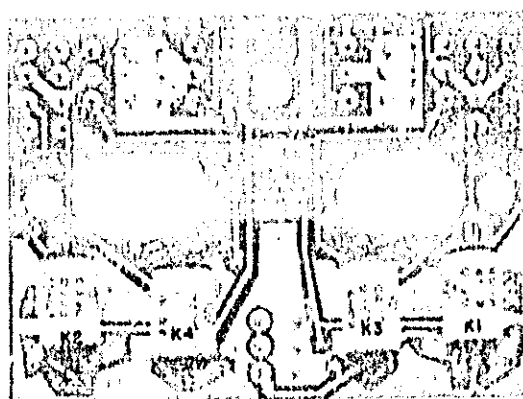
1. DIFFERENT REGULATIONS OF THE TWO 1170 AND 1171 VOLT MAINLY ASSEMBLYS ARE NOT ALLOWED TO BE USED TOGETHER.
2. THE 1170 AND 1171 VOLT MAINLY ASSEMBLYS ARE NOT TO BE USED TOGETHER.

DIFFERENT REGULATIONS		
NO.	1170	1171
1	1170	1171
2	1170	1171
3	1170	1171
4	1170	1171
5	1170	1171
6	1170	1171
7	1170	1171
8	1170	1171
9	1170	1171
10	1170	1171
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80	1170	1171
81	1170	1171
82	1170	1171
83	1170	1171
84	1170	1171
85	1170	1171
86	1170	1171
87	1170	1171
88	1170	1171
89	1170	1171
90	1170	1171
91	1170	1171
92	1170	1171
93	1170	1171
94	1170	1171
95	1170	1171
96	1170	1171
97	1170	1171
98	1170	1171
99	1170	1171
100	1170	1171

Figure 7-16, 05325-60033 A1 Option 01 Attenuator Parts Locator



FRONT



REAR

Figure 7-17. 05325-60033 A1 Option 01 Attenuator Schematic

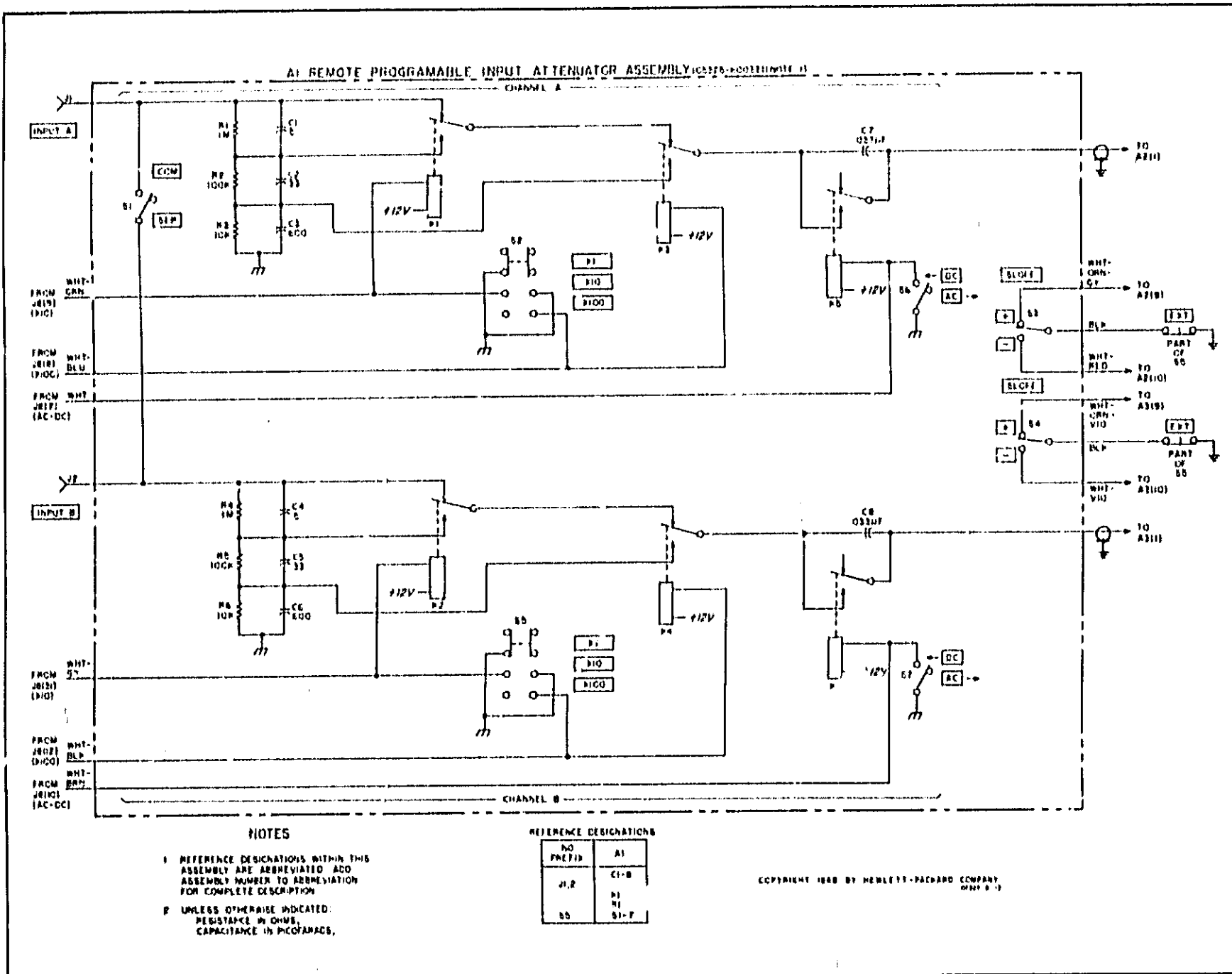


Figure 7-18. 05325-00001 A3 Amplifier-Trigger Parts Location

R38	R37		R42
R34	C16	C19	R41
R30			CR10
R35	Q8 Q9 Q9		CR7
R40			C12
R31	R33	CR9	Q10
CR5			R36
CR6	C15	C17	CR8
R32			C15
R28	R23	C14	R43
		C9	R39
C11	Q7	R27	
C7		R29	Q6
R17	Q5	R21	R22
C4		R24	R25
		C8	R26
R13		R18	
C5			
R16	Q4	R12	C10
		R15	C1
		R9	R19
			R14
			R20
	Q2	Q1B	C6
	Q1A	Q3	C2
R5			R11
C3		R44	R3
R8		R4	C20
R6		R7	R2
R10		CR2	CR4
		CR1	CR3

A3 AMPLIFIER/TRIGGER ASSEMBLY (CONT. BOTTOM VIEW)

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED ADO ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.

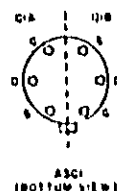
2. UNLESS OTHERWISE INDICATED:
RESISTANCE IN OHMS
CAPACITANCE IN MICROFARADS
INDUCTANCE IN MICROHENRIES

REFERENCE DESIGNATIONS		
NO. PREFIX	A1	A3
C1-4		C1-20 C1-10
J4		
L8		
R5		Q1-11 R1-44
S7	S4	

ASCI
(BOTTOM VIEW)

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HMS-1

REFERENCE DESIGNATIONS		
NO PREFIX	A1	A3
CP-4		C1-FO CR1-10
JA		
LS		
MS		C1-11
ST	SA	M1-44



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Figure 7-20. 5325B J8 Remote Program Connector

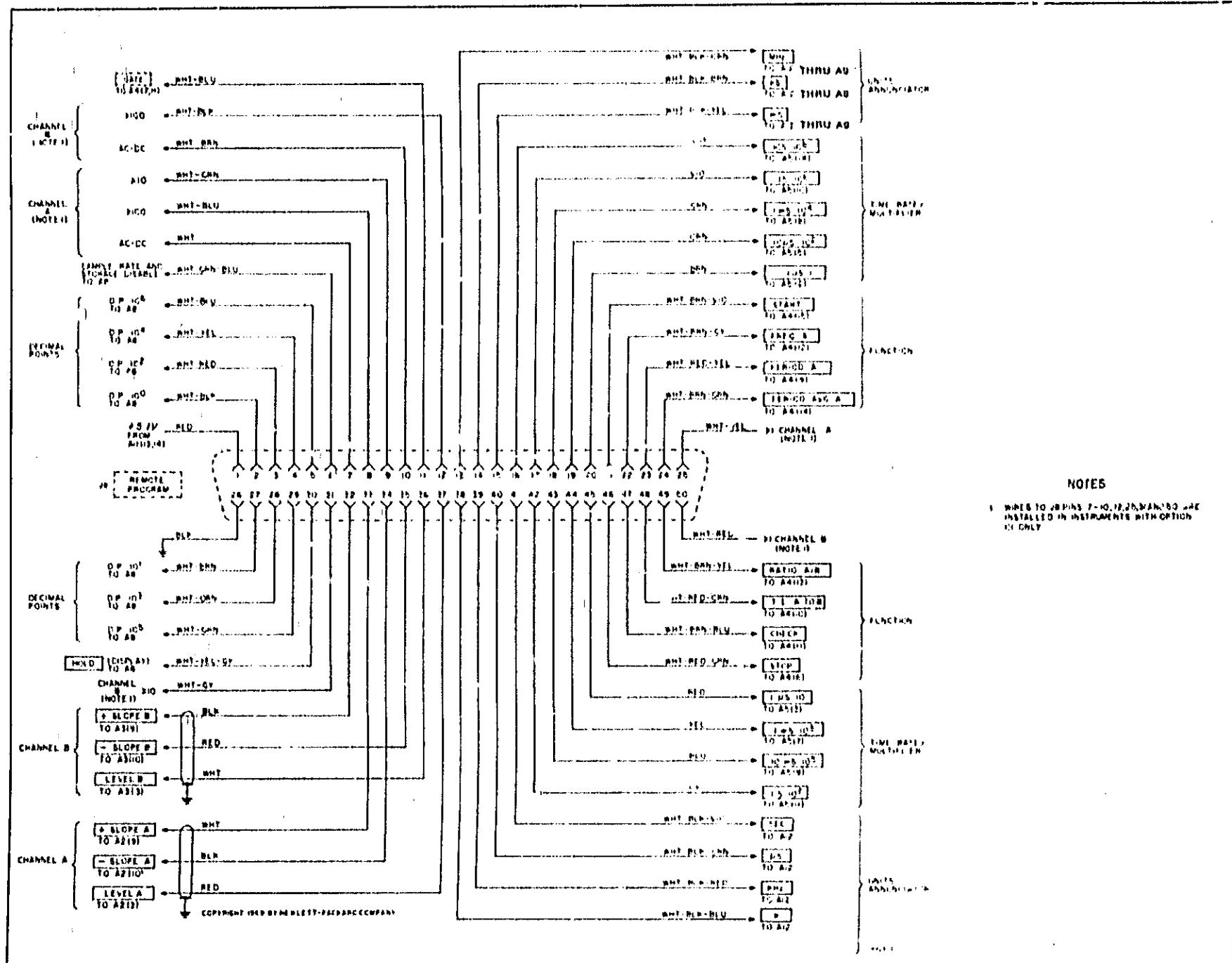
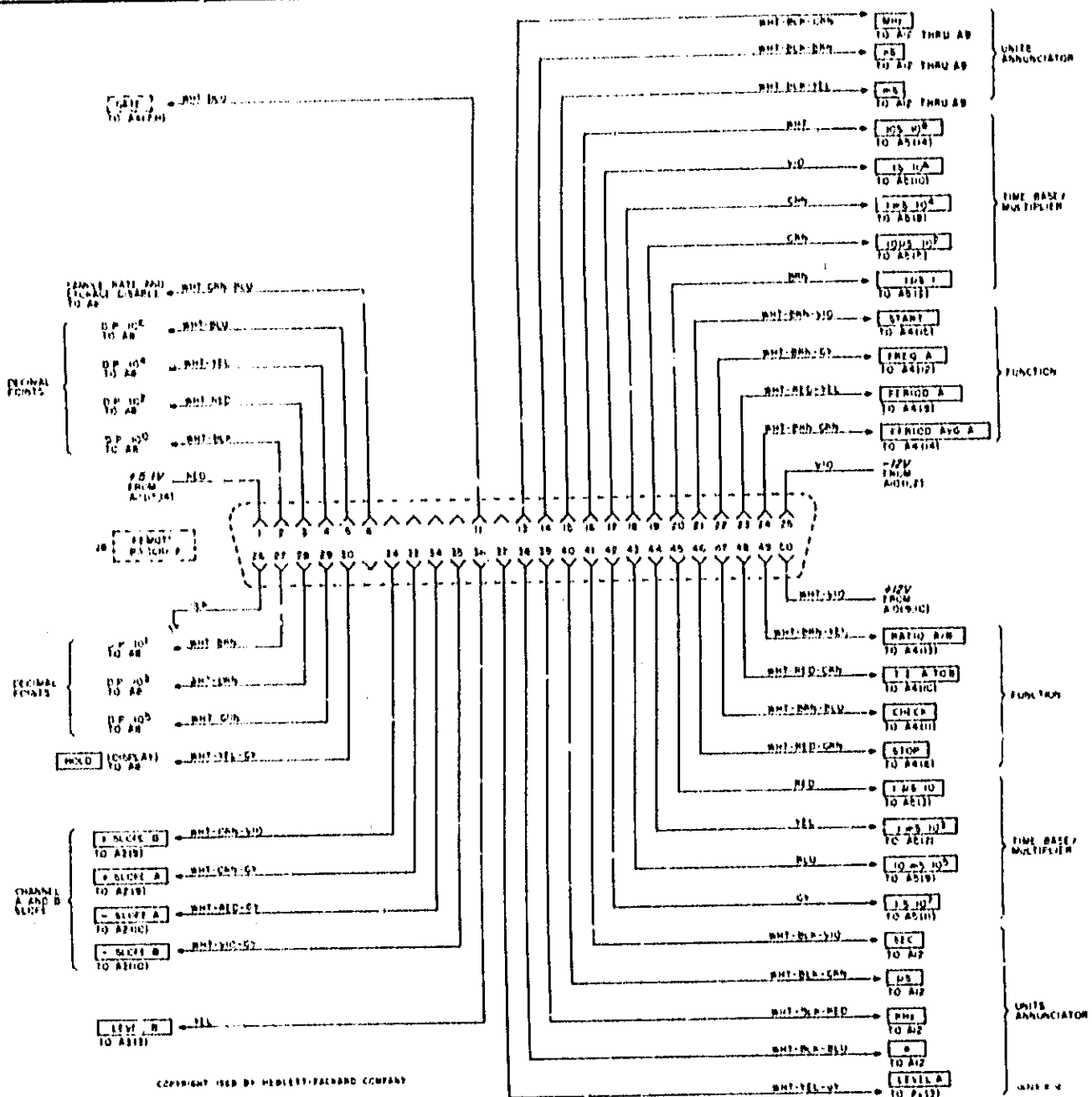


Figure 7-21. 5325B J8 Remote Program Connector



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Figure 7-22 A7 Oscillator Multiplier 05325-00008 Parts Location

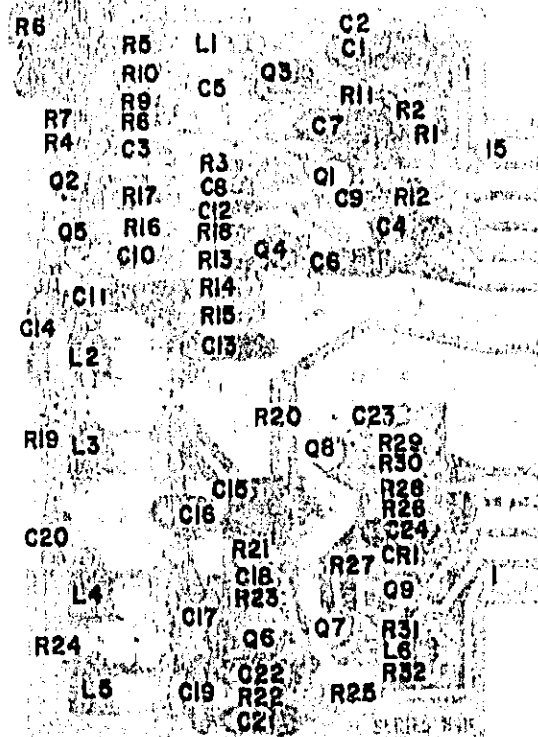


Figure 7-24. A7 Oscillator Multiplier 05325-60040 Series 1044 Parts Location

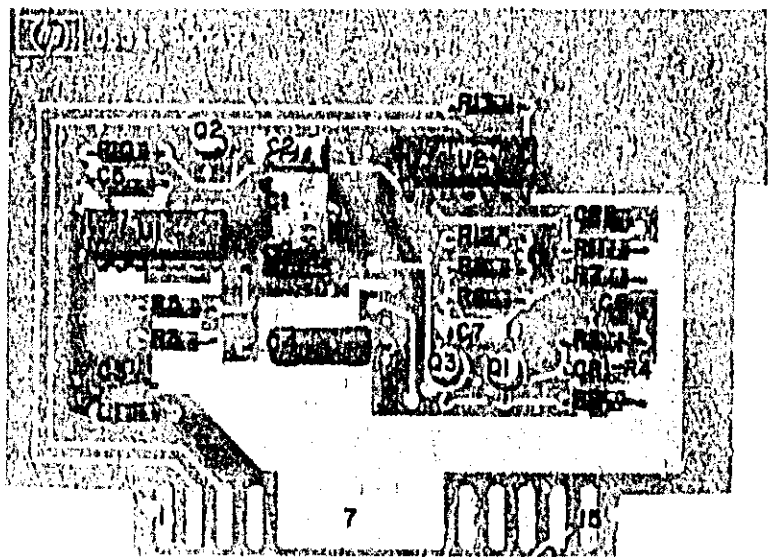


Figure 7-25. A7 Oscillator Multiplier 05325-60049 Series 1044 Schematic

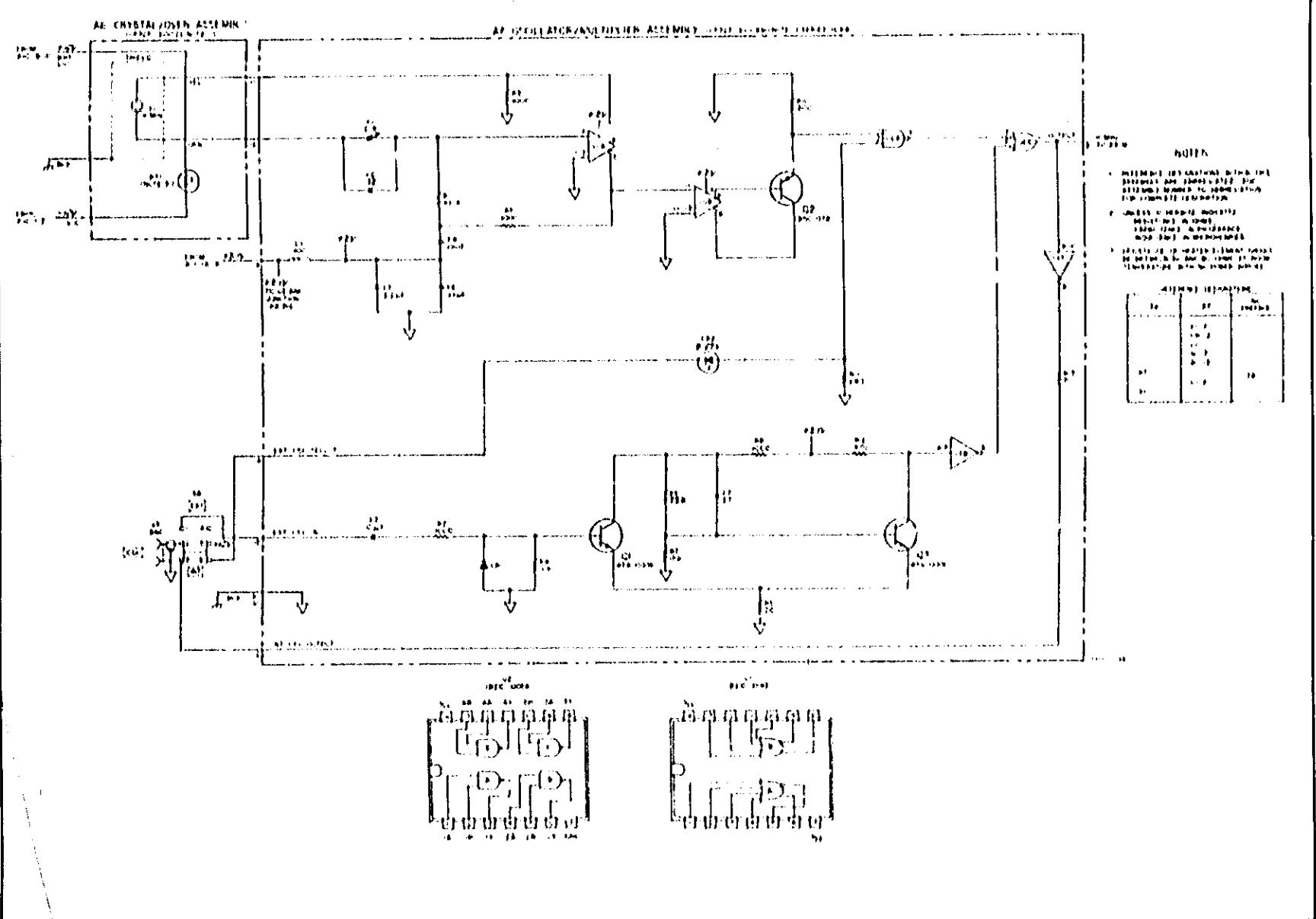


Figure 7-20. A7 Operator Multiplier 05325-60049 Series 1112 Parts Location

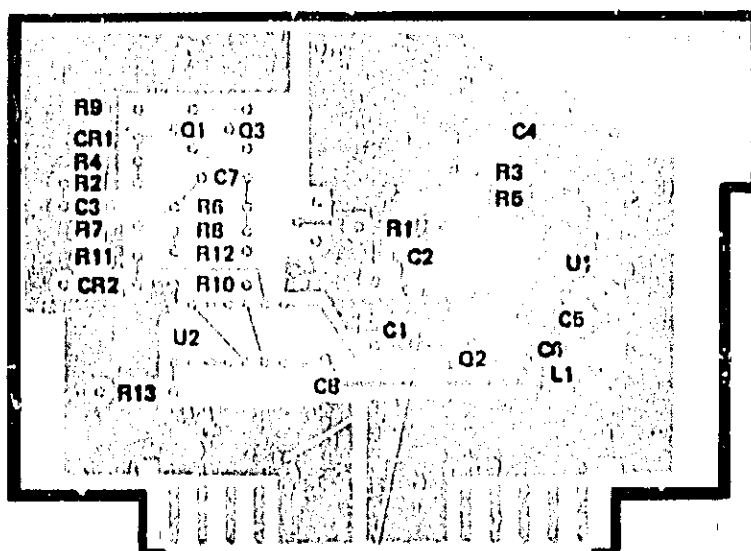


Figure 7-27. A7 Oscillator Multiplier 05325-60049 Series 1112 Schematic

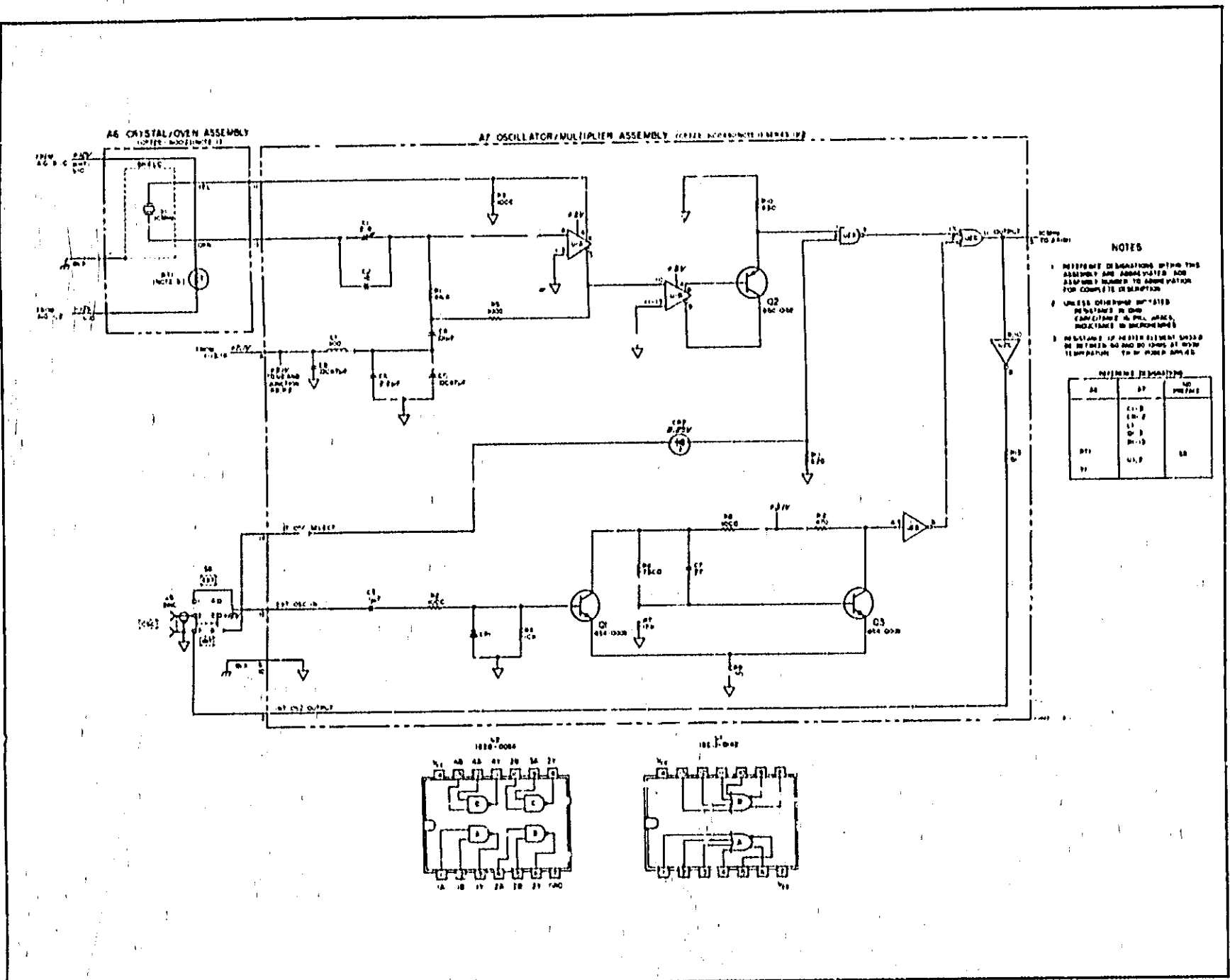
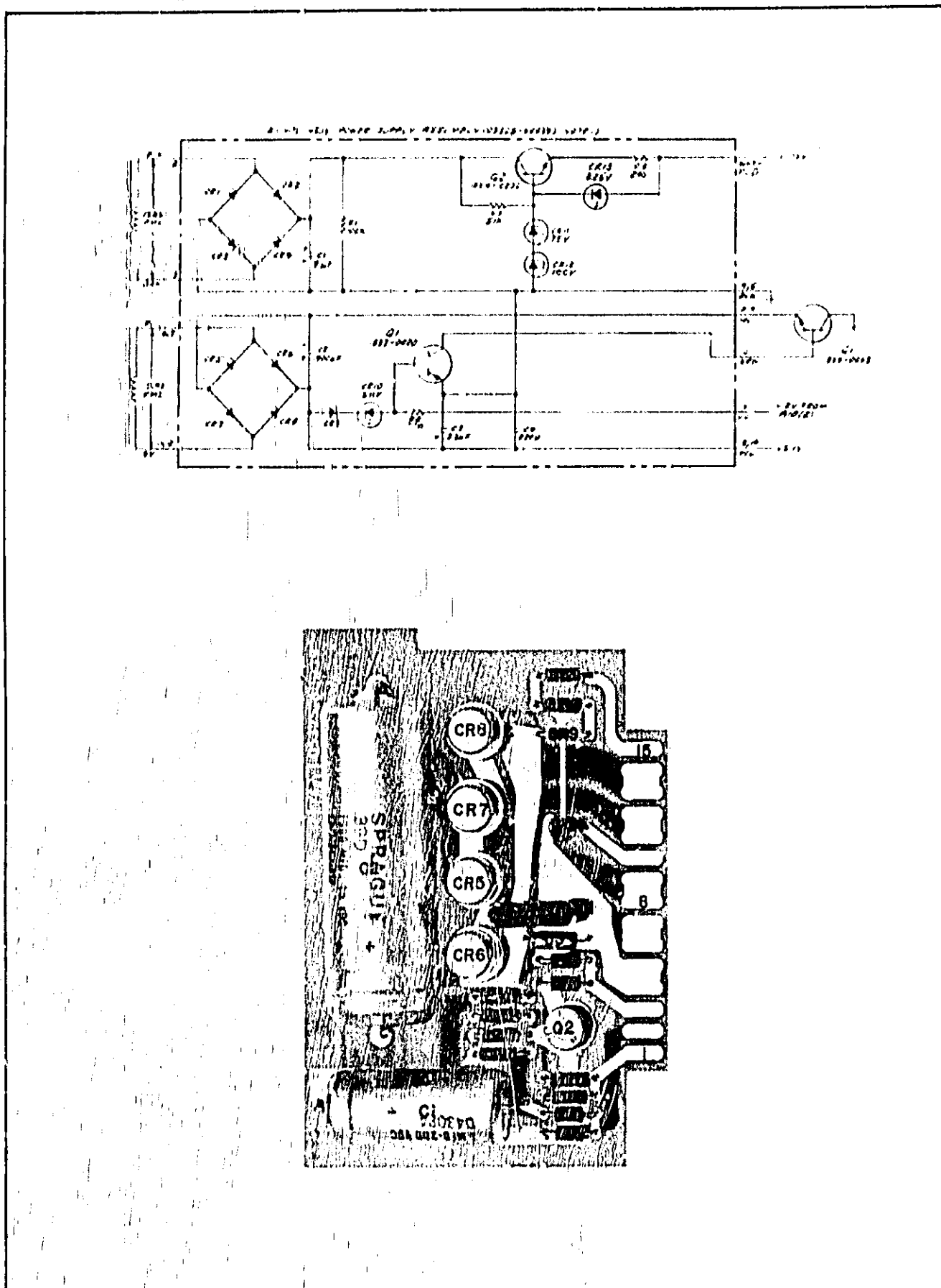


Figure 7-28. A11 Power Supply 05325-00039 Schematic and Parts Location



SCHEMATIC DIAGRAMS

SECTION VIII

CIRCUIT DIAGRAMS

8-1. This section includes the following:

a. General notes for schematic diagrams in Figure 8-1.

b. Flow diagrams for function selector assembly A4 in Figures 8-2 through 8-8.

c. Schematic diagrams and component locators for all printed circuit boards including theory of operation and troubleshooting procedures in Figures 8-13 through 8-18. These figures may also include waveforms and voltages. Top views of integrated circuits are shown with pin numbers for identification.

8-2. The diagrams, when unfolded, can be used with other parts of the manual or when the manual is closed.

8-3. DC voltages are measured with HP Model 412A VT VM. Typical voltages are shown.

8-4. Shaded areas on the schematic diagrams indicate printed circuit assemblies. All components within the shaded areas are mounted on the boards.

Figure 8-1. Schematic Diagram Notes

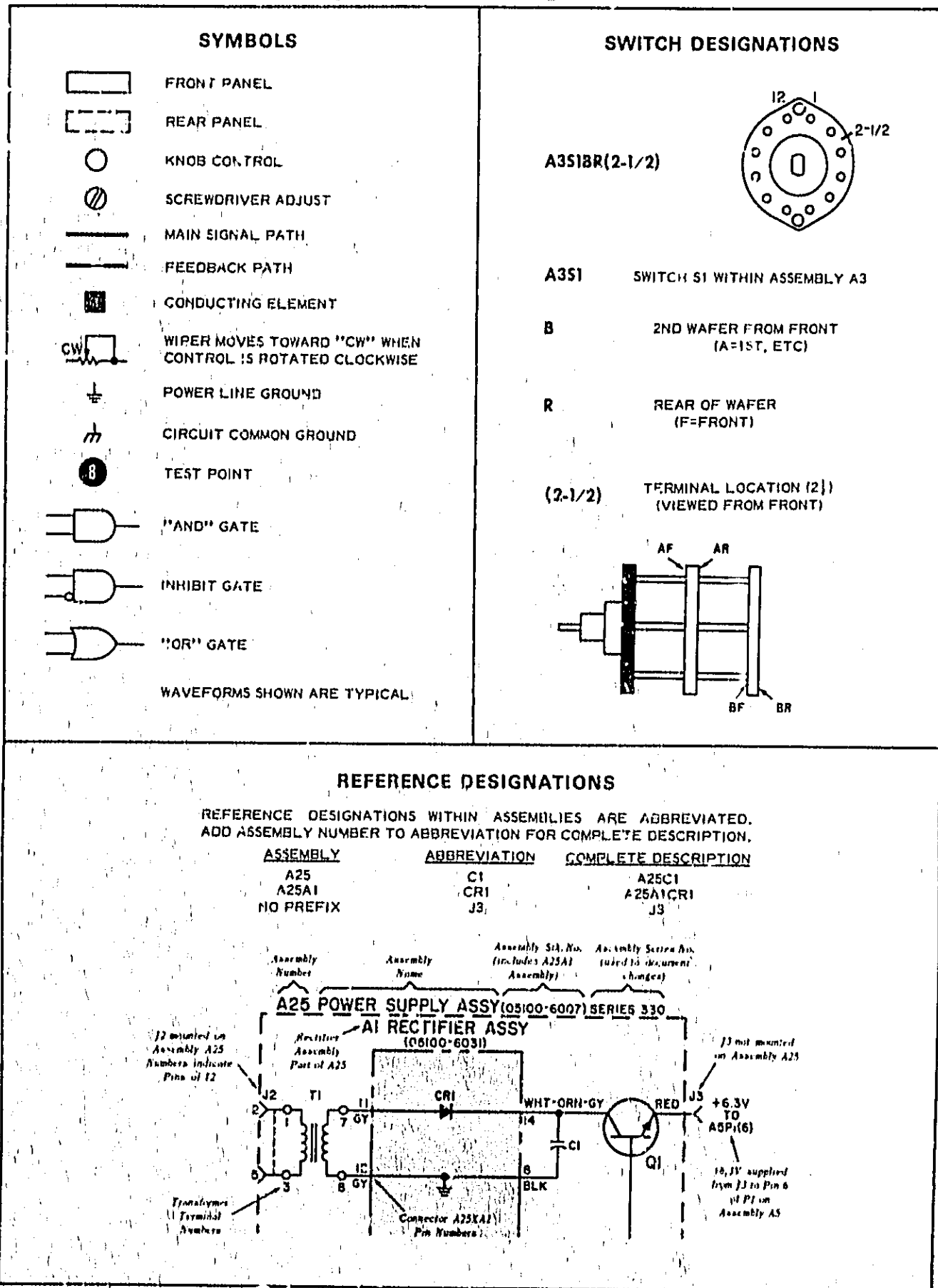
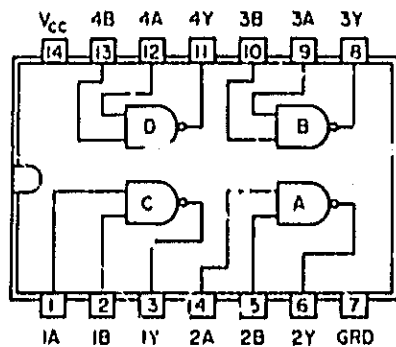
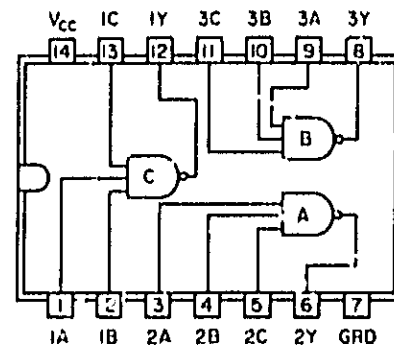


Figure 8-1. Integrated Circuit Diagram



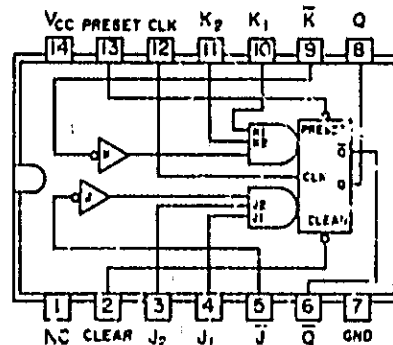
1820-0054(SN7400N)
QUADRUPL 2-INPUT POSITIVE NAND GATE
NOTE: POSITIVE LOGIC: $Y = AB$

1820-0054



1820-0066(SN7410N)
TRIPLE 3-INPUT POSITIVE NAND GATE
POSITIVE LOGIC: $Y = ABC$

1820-0066



1820-0065(SN7470N)
J-K FLIP-FLOP

POSITIVE LOGIC
LOW INPUT TO PRESET SETS Q TO LOGICAL 1
LOW INPUT TO CLEAR SET Q TO LOGICAL 0

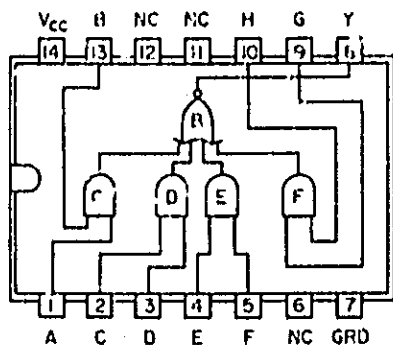
1820-0065

TRUTH TABLE

t_n	t_{n+1}	Q
J	K	Q
0	0	Q_n
0	1	0
1	0	1
1	1	\bar{Q}_n

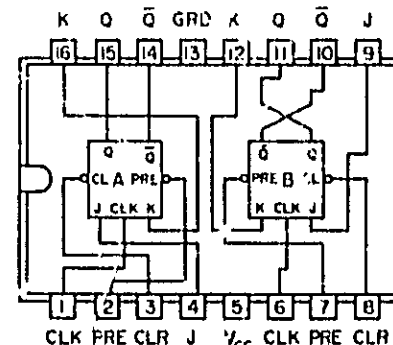
NOTE:
CLOCK MUST BE AT LOGICAL 0 PRIOR TO THE APPLICATION OF PRESET OR CLEAR FUNCTIONS.

NOTES:
1. $J = J_1, J_2, \bar{J}$
2. $K = K_1, K_2, \bar{K}$
3. t_n = BIT TIME BEFORE CLOCK PULSE
4. t_{n+1} = BIT TIME AFTER CLOCK PULSE



1820-0074(SN7454N)
4-WIDE 2-INPUT AND-OR-INVERT GATES
POSITIVE LOGIC: $Y = (AB) + (CD) + (EF) + (GH) + X$

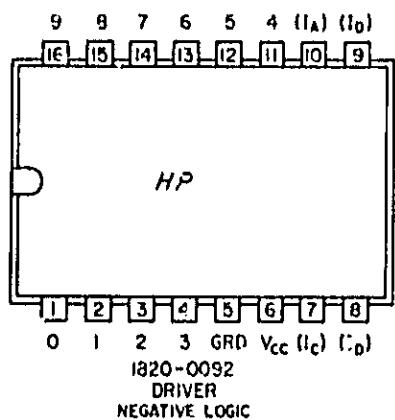
1820-0074



1820-0076(SN7476N)
DUAL J-K MASTER-SLAVE FLIP-FLOP
WITH PRESET AND CLEAR

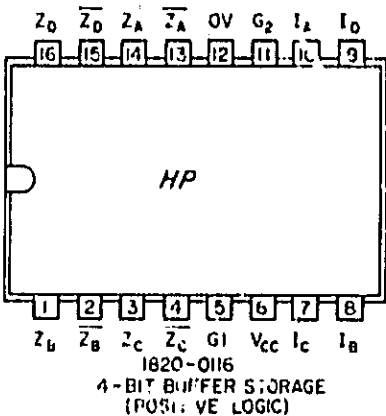
1820-0076

Figure 8-1. Integrated Circuit Diagram (Continued)

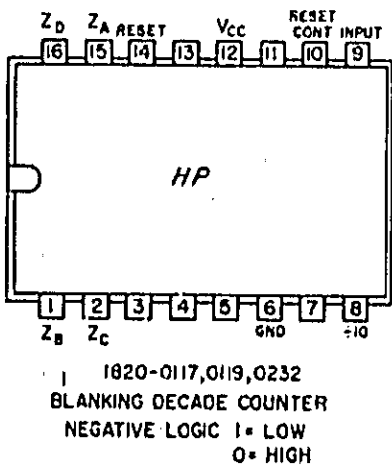


I _A (1)	I _B (2)	I _C (4)	I _D (8)	"ON" OUTPUT
H	H	H	H	0
L	H	H	H	1
H	L	H	H	2
L	L	H	H	3
H	H	L	H	4
L	H	L	H	5
H	L	L	H	6
L	L	L	H	7
H	H	H	L	8
L	H	H	L	9
BCD 10-15				NONE

1820-0092



1820-0116

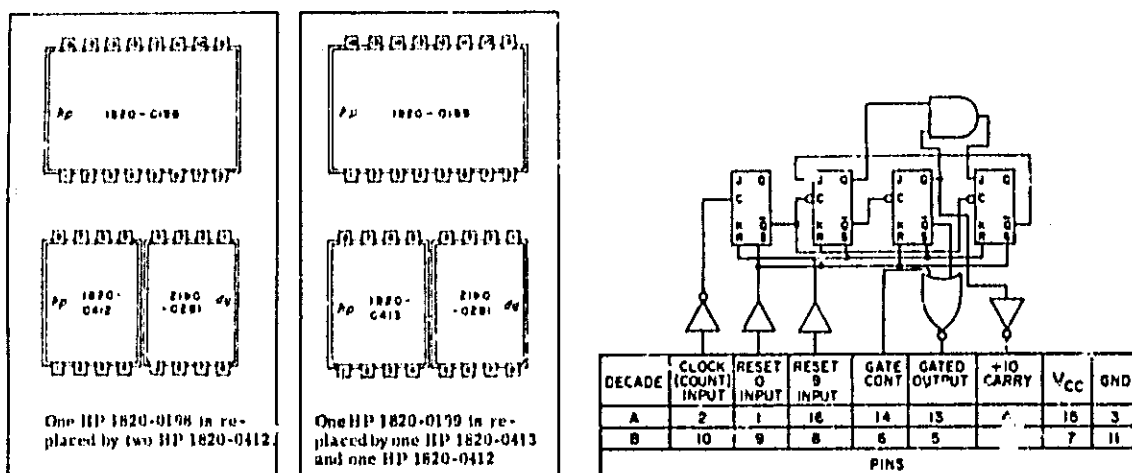


TRUTH TABLE				
OUTPUT				
INPUT PULSE	A	B	C	D
0	H	H	H	H
1	L	H	H	H
2	H	L	H	H
3	L	L	H	H
4	H	H	L	H
5	L	H	L	H
6	H	L	L	H
7	L	L	L	H
8	H	H	H	L
9	L	H	H	L
RESET CONTROL HIGH & RESET PULSE	H	H	H	H
RESET CONTROL LOW & RESET PULSE	L	L	L	L

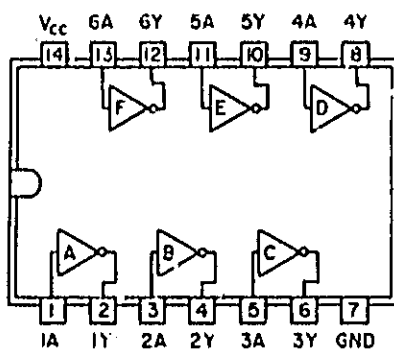
POSITIVE PULSE APPLIED TO RESET WILL:
A. RESET A, B, C & D TO LOW IF RESET CONTROL IS LOW.
B. RESET A, B, C & D TO HIGH IF RESET CONTROL IS HIGH.
C. THE +10 OUTPUT WILL ALWAYS BE RESET TO HIGH STATE

1820-0117, 1820-0119

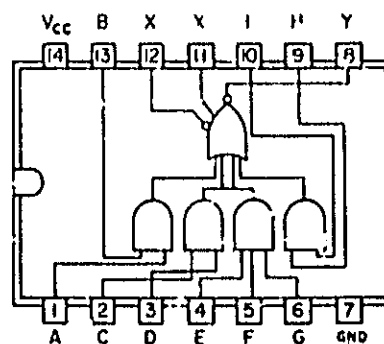
Figure 8-1. Integrated Circuit Diagram (Continued)



1820-0198, 1820-0199

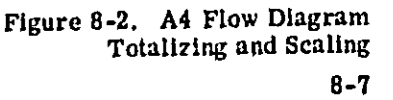


1820-0307

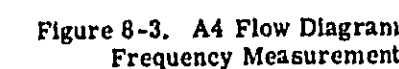


1820-0380

The main gate F-F is controlled by the STAR-STOP push buttons. In START, the Channel A input signal is directed through IC7 to Time Base assembly A5, where it may be scaled from 10^0 to 10^8 . The scaled output from A5 is fed to A4(B,J). This signal then goes through IC6 to A4(S) and is used for the counted signal. The scaled output from A5 also goes through IC8c to the TIME BASE jack on the rear panel. When the STOP button is pressed, the main gate F-F changes states and the main gate closes. The total number of input pulses is then displayed.

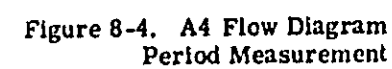


The 10 MHz clock signal from Oscillator/Multiplier assembly A7 goes through IC7 to Time Base assembly A5. The output from A5 ($1 \mu\text{s}$ to 10 sec) is applied to A4(8,J) and becomes the clock for the main gate F-F. The Channel A input signal goes through IC6 and is the counted signal to the main gate.



**SCHEMATIC
DIAGRAMS
CON'T**

The 10 Mhz clock from Oscillator/Multiplier assembly A7 goes through IC7 to Time Base assembly A5. The output from A5 (.1 Hz to 10 Mhz) goes through IC6 and becomes the counted signal to the main gate. The Channel A input signal is the clock input to the main gate F-F.



PERIOD AVERAGE MEASUREMENT

The Channel A input signal goes through IC7 to Time Base assembly A5. The output of A5 (10^0 to 10^8 periods) is applied to A4(8, J) and is the clock input to the main gate F-F. The 10 MHz clock from Oscillator/Multiplier assembly A7 goes through IC6 and is the counted signal to the main gate.

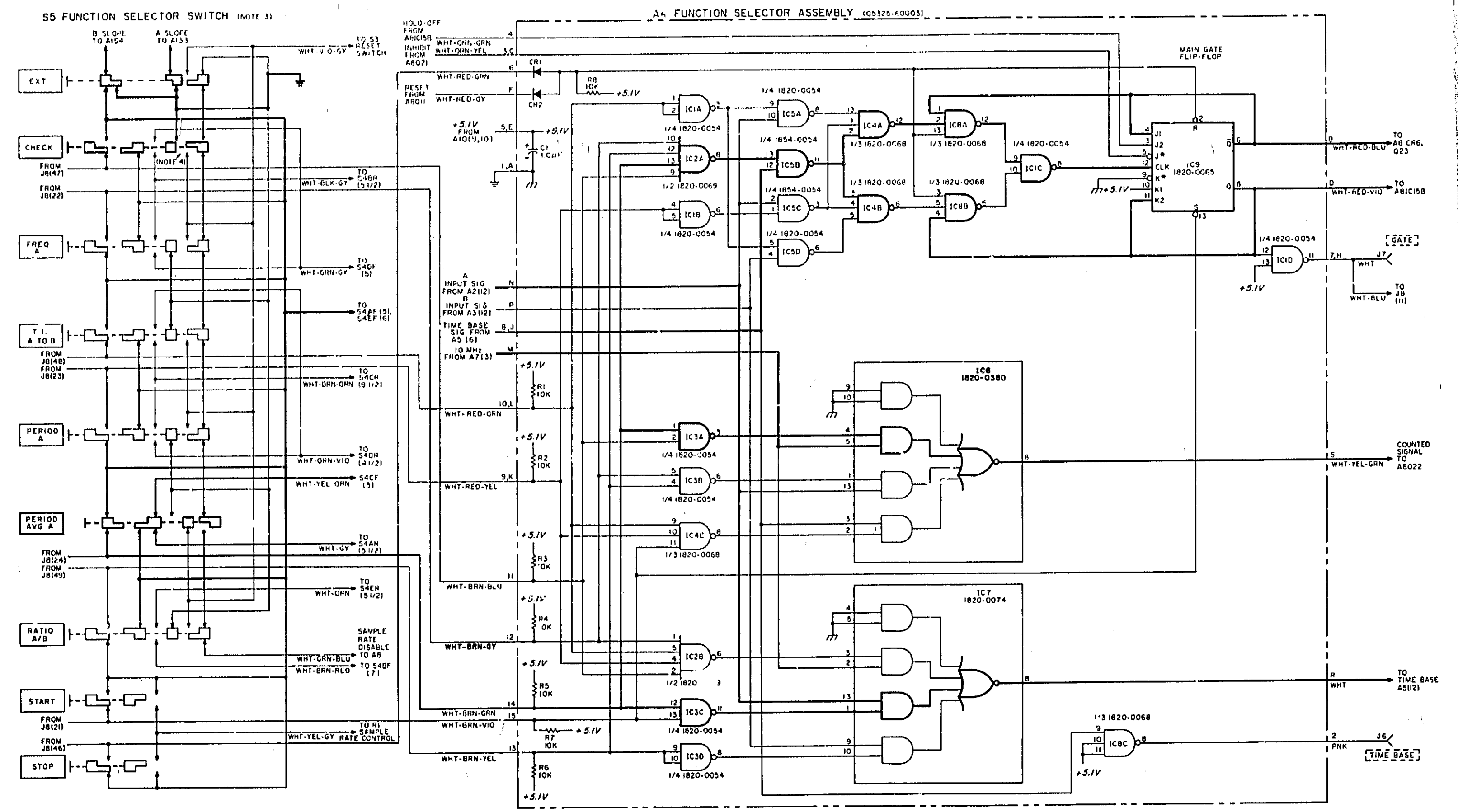
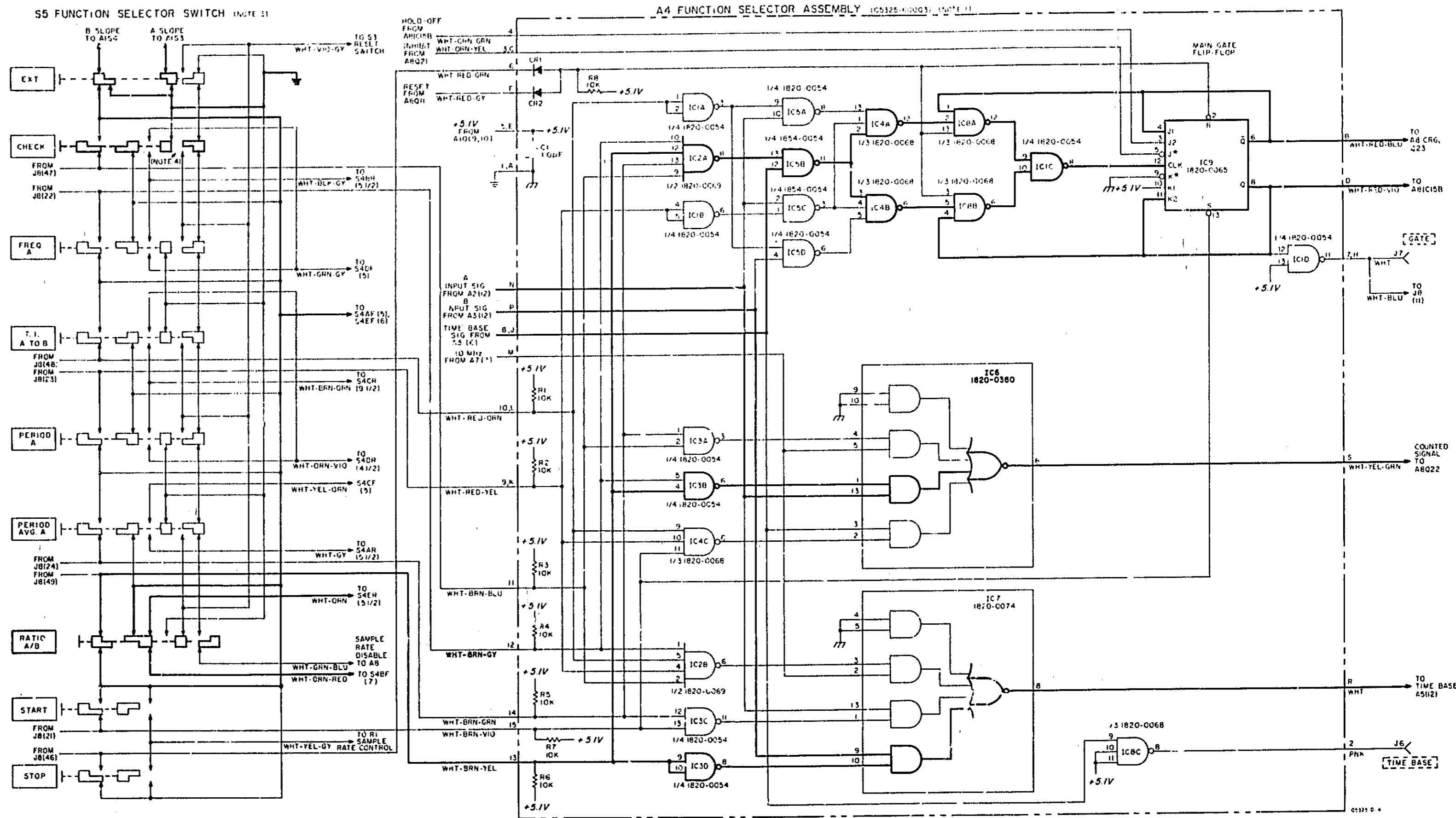


Figure 8-5. A4 Flow Diagram
Period Average Measurement
8-13

RATIO MEASUREMENT

The Channel A input signal goes through IC6 and is the counted signal to the main gate. The Channel B input signal goes through IC7 to Time Base assembly A5. The output of A5 (10^0 to 10^6 multiplier) is applied to A4(8, J) and is used for the clock input to the main gate F-F.

Figure 8-6. A4 Flow Diagram
Ratio Measurement

TIME INTERVAL MEASUREMENT

The Channel A input signal triggers the main gate F-F which opens the main gate. The Channel B input signal triggers the main gate F-F which closes the main gate. The 10 MHz clock signal from Oscillator/Multiplier assembly A7 goes through IC7 to Time Base assembly A5. The output of A5 (1 μ s to 10⁸ seconds) is applied to A4(8, J) and is used for the counted signal to the main gate.

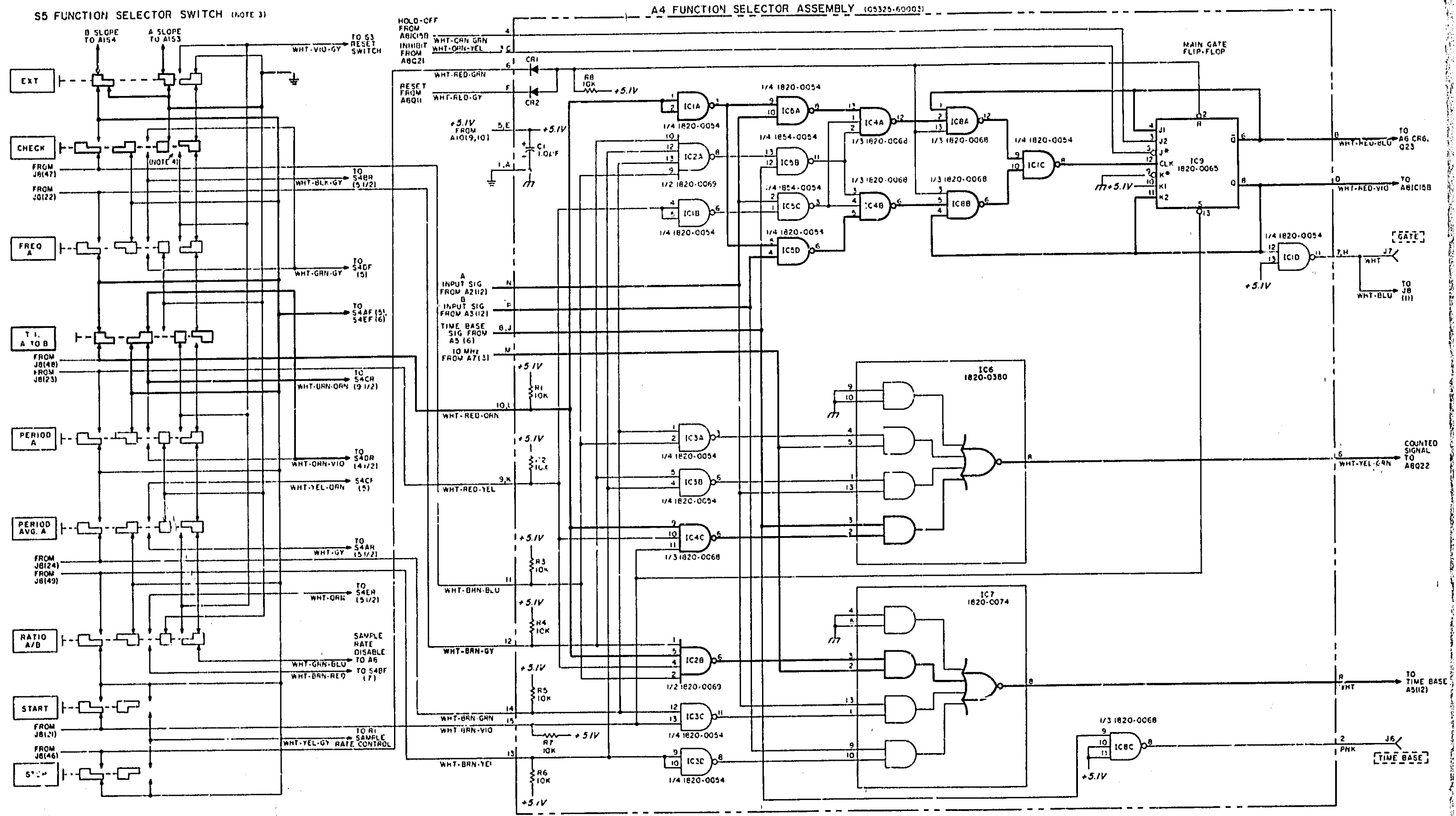


Figure 8-7. A4 Flow Diagram
Time Interval Measurement

The 10 MHz clock from the Oscillator/Multiplier assembly A7 goes through IC6 and is the counted signal to the main gate. The 10 MHz clock signal also goes through IC7 to Time base assembly A5. The output of A5 (1 μ s to 16 sec) is the clock input for the main gate F-F.

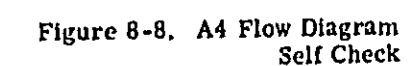


Figure 8-13. Top Internal

GENERAL TROUBLESHOOTING

This section gives general troubleshooting procedures to identify which assembly is defective.

TROUBLE AT TURN ON. If the Counter does not operate when it is turned on (no display, no decimal point and no measurement unit*) make the following checks:

- Line voltage switch must be set to correct voltage (115 V or 230 V as appropriate).
- Power cord plugged into Counter and ac power outlet.
- Line fuse good.
- AC power on at outlet.

COUNTER QUICK CIRCUIT CHECKS: Make the following quick checks if the Counter does not operate.

- Remove the top and bottom covers. Set the Counter control as follows:

Function Switch	CHECK	CHANNEL A and B	X1
TIME BASE	.1 μ s	ATTEN	AC
SAMPLE RATE pot	Counterclockwise but on	AC-DC	PRESET
SAMPLE RATE slide switch	FAST	LEVEL	SEP
		SEP-COM	ON
		STORAGE	INT
		INT-EXT	

- Connect Counter power cord to correct ac outlet.
- Continue with the quick check that follow to locate which assembly a trouble is in.

A10 AND A11 POWER SUPPLY QUICK CHECKS

- Turn SAMPLE RATE knob clockwise.
- Measure +175 Vdc (+170 in some models) at pin 1 of A11. If this voltage is not correct, refer to A11 schematic diagram and troubleshooting procedure.
- Measure +5.1 Vdc at pins 13 and 14 of A11. If this voltage is not correct, refer to the A11 schematic diagram and troubleshooting procedure.
- Measure +12 Vdc at pins 9 and 10, and -12 Vdc at pins 1 and 2 of A10. If these voltages are not correct, refer to A10 schematic diagram and troubleshooting procedure.

A6-A7 OSCILLATOR QUICK CHECKS

Check the output of the oscillator at the rear panel OSC connector with an oscilloscope. If the 10 MHz signal is not present, refer to A6-A7 schematic diagram and troubleshooting procedure.

A4 FUNCTION SELECTOR QUICK CHECK

- With oscilloscope, check pins R and S of the Function Selector for 10 MHz signal.
- Check pin M for 10 MHz signal. If the 10 MHz signal is not at pins R and S, but is at pin M refer to A4 Function Selector schematic diagram and troubleshooting procedure. If the signal is not at pin M, check the chassis wiring between A and A4.

A5 TIME BASE QUICK CHECK

- Switch power OFF.
 - On A8 Counter Board, disconnect reset (white-red-gray) and holdoff (white-orange-green) wires.
 - On A8 disconnect and ground inhibit (white-orange-yellow) wires.
 - Set the Counter controls as follows:
- | Function Switch | CHECK | CHANNEL A and B | X1 |
|--------------------------|-------------------------|-----------------|--------|
| TIME BASE | .1 μ s | ATTEN | AC |
| SAMPLE RATE pot | Counterclockwise but on | AC-DC | PRESET |
| SAMPLE RATE slide switch | FAST | LEVEL | SEP |
| | | SEP-COM | ON |
| | | STORAGE | INT |
| | | INT-EXT | |

*At least the right zero digit should be on regardless of front panel control setting if power is ON.

- With oscilloscope, check for 10 MHz signal at A5 pin 12. If signal is absent, check wiring from A4. If 10 MHz is present do next step.

- Check for 10 MHz at A5 pin 6. If 10 MHz is present, A5 is probably OK. If 10 MHz is absent refer to A5 schematic diagram and troubleshooting procedure.

A4 FUNCTION SELECTOR MAIN GATE F-F QUICK CHECK

- Switch power OFF.
- On A8 Counter Board, disconnect reset (white-red-gray) and holdoff (white-orange-green) wires.
- On A8 disconnect and ground inhibit (white-orange-yellow) wire.
- Set Counter controls as follows:

Function Switch	CHECK
TIME BASE	.1 μ s
SAMPLE RATE pot	Counterclockwise but on
SAMPLE RATE slide switch	FAST
CHANNEL A and B	
ATTEN	X1
AC-DC	AC
LEVEL	PRESET
SEP-COM	SEP
STORAGE	ON
INT-EXT	INT

- With oscilloscope check for 5 MHz signal at A4 pins B and D. If signal is present, A4 main gate F-F is OK. If signal is absent refer to A4 schematic diagram and troubleshooting procedure.

A8 COUNTER BOARD-HOLDOFF, RESET, TRANSFER, AND INHIBIT SIGNALS QUICK CHECK

- Switch power OFF.
- On A8 Counter Board, disconnect reset (white-red-gray) and holdoff (white-orange-green) wires.
- On A8 disconnect and ground inhibit (white-orange-yellow) wire.
- Set Counter controls as follows:

Function Switch	CHECK
TIME BASE	.1 μ s
SAMPLE RATE pot	Counterclockwise but on
SAMPLE RATE slide switch	FAST
CHANNEL A and B	
ATTEN	X1
AC-DC	AC
LEVEL	PRESET
SEP-COM	SEP
STORAGE	ON
INT-EXT	INT

- With oscilloscope (HF) check for holdoff signal at terminal marked WHT-ORN-GRN (see Figure 8-9). (Set oscilloscope: Vert - 2 V/cm, dc + up.)

- Check for reset signal at terminal marked WHT-RED-GRY and terminal marked WHT-YEL-BLU (see Figure 8-10).

- Check for transfer pulse at A8IC17(3) (see Figure 8-11).

- Change the TIME BASE to 10 μ s and check for inhibit signal at terminal marked WHT-ORN-YEL (see Figure 8-12).



Fig. 8-9 Waveform

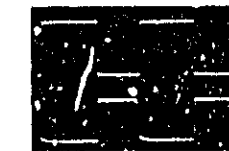


Fig. 8-10 Waveform



Fig. 8-11 Waveform

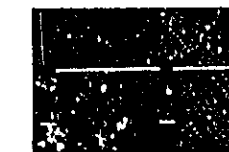


Fig. 8-12 Waveform

- If all four signals are present the Counter Board is producing these signals correctly. If any signal is absent, refer to the Counter Board schematic diagram and troubleshooting procedure.

A2-A3 INPUT AMPLIFIER QUICK CHECK

- Switch power OFF.
- Set the Counter controls as follows:

Function Switch	PERIOD AVG A
TIME BASE/MULTIPLIER	10 ⁵
SAMPLE RATE pot	Mid-range
CHANNEL A and B	
ATTEN	X1
AC-DC	AC
LEVEL	PRESET
SEP-COM	COM
STORAGE	ON
INT-EXT	INT

- Connect the 10 MHz OSC output on the Counter rear panel to the CHANNEL A INPUT.

- With oscilloscope, check for 10 MHz signal at A2 and A3 pin 12. If signal is present A1, A2, and A3 are probably OK. If the signal is absent refer to the A1, A2, and A3 schematic diagram and troubleshooting procedure.

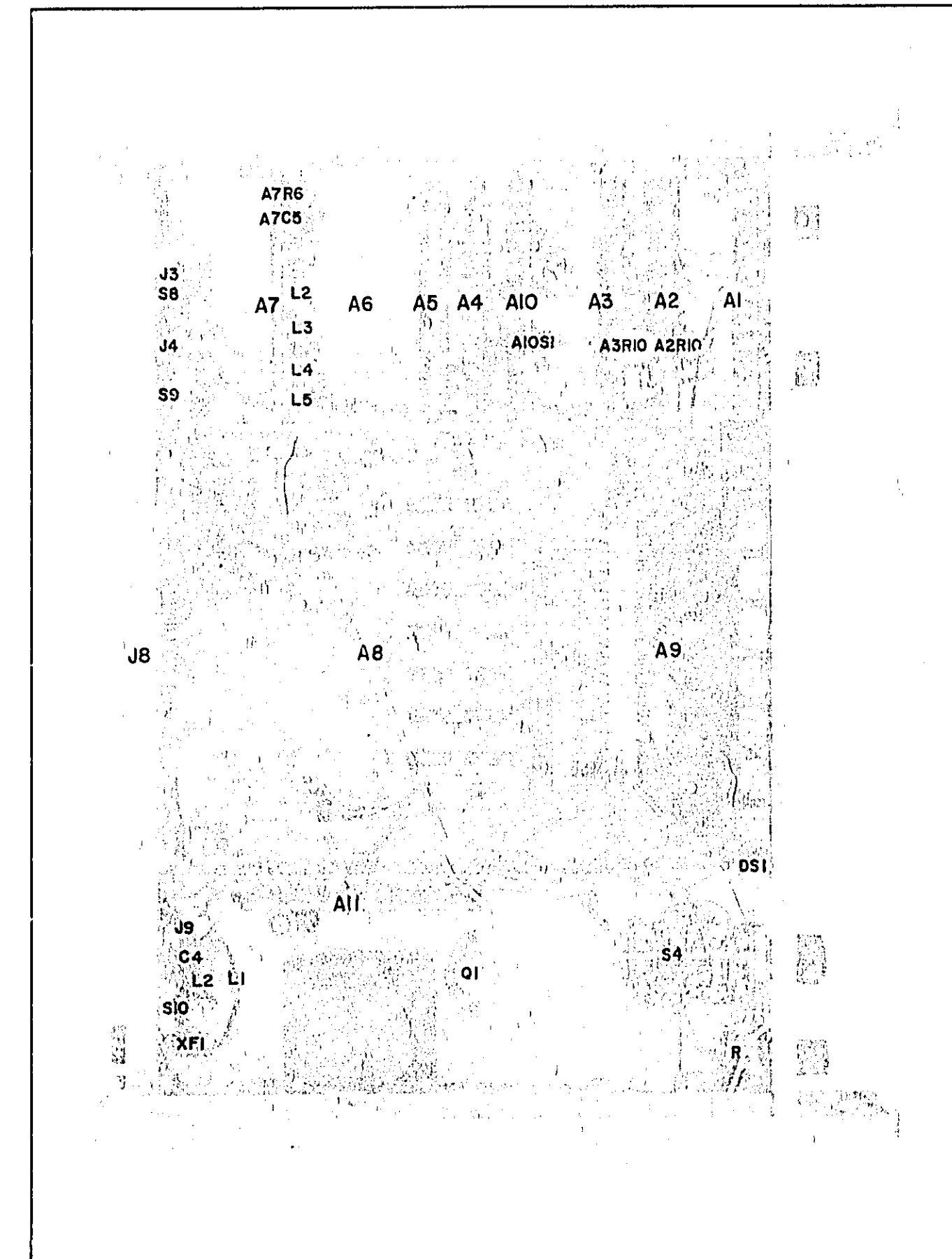


Figure 8-8
A4 FLOW DIAGRAM
SELF CHECK
(See page 8-10)

Figure 8-14. Bottom Internal

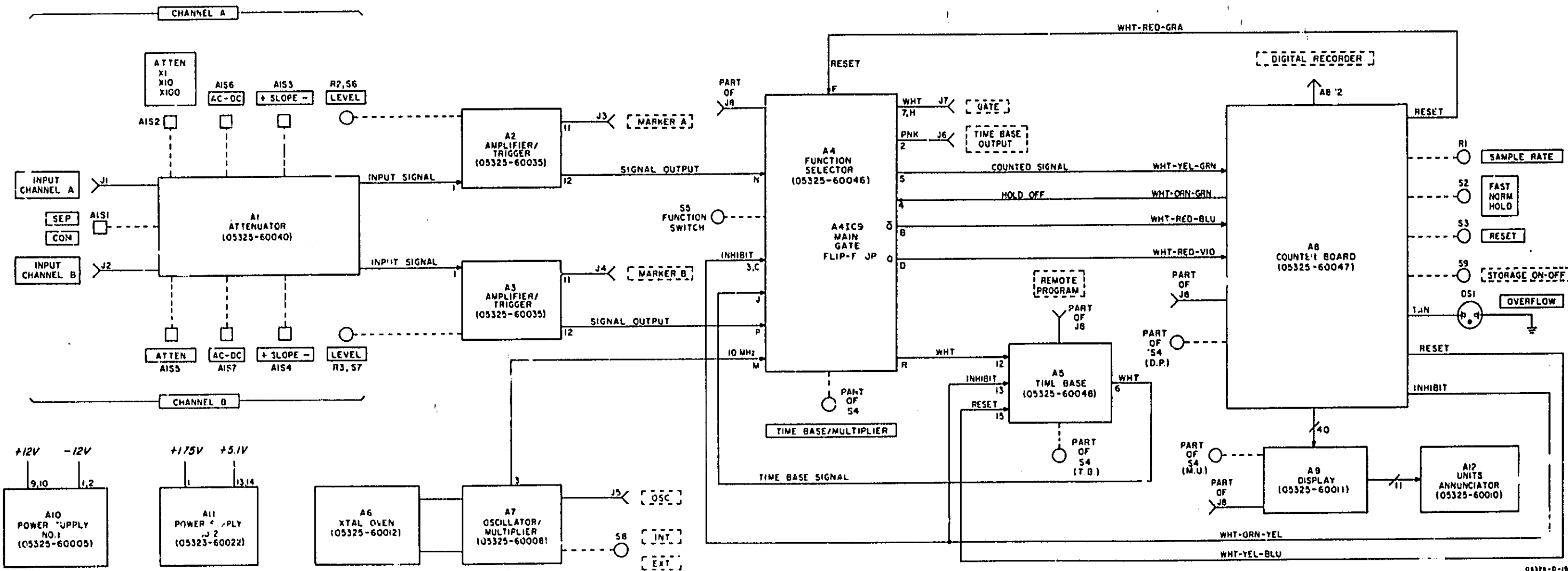
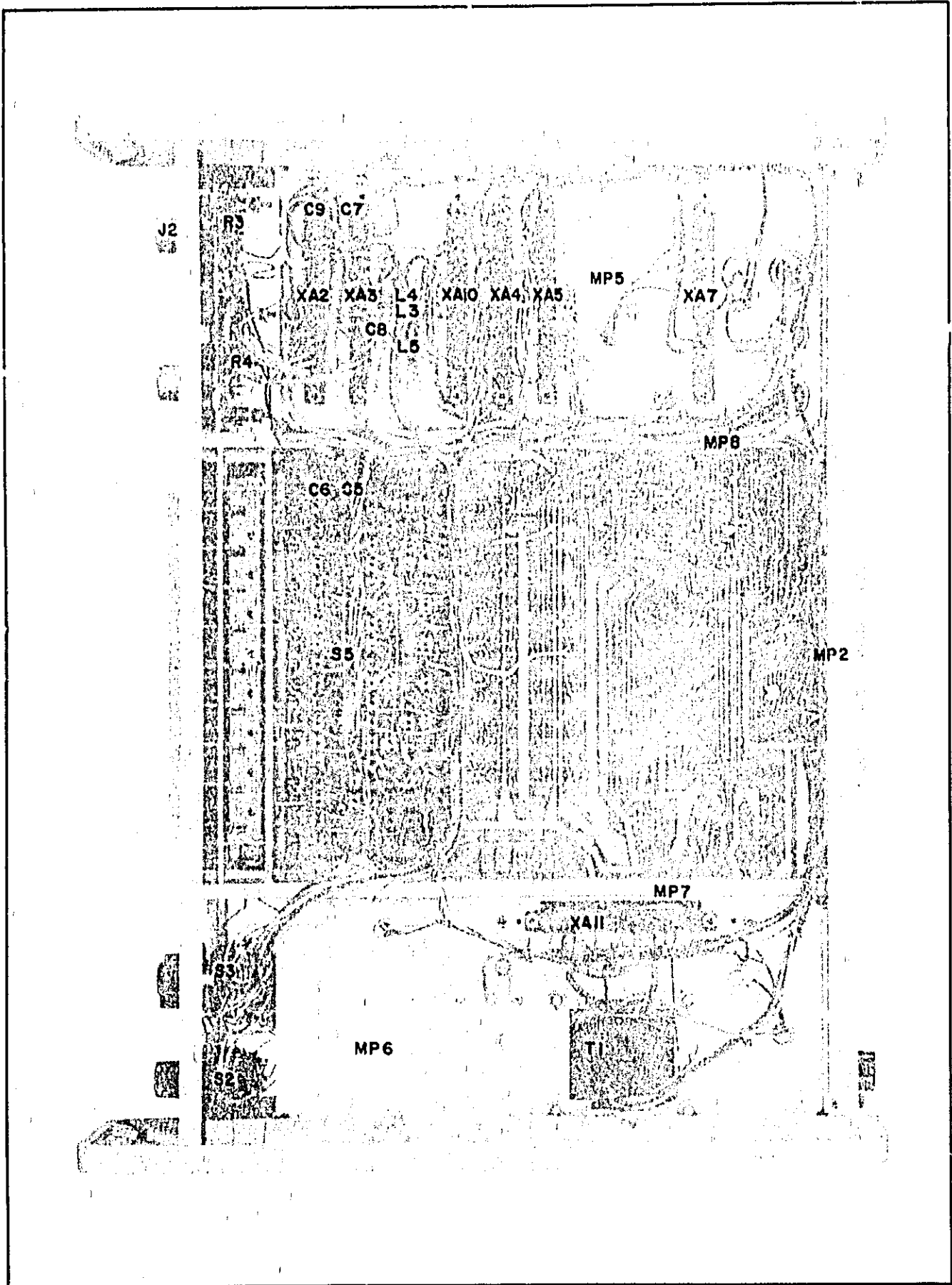


Figure 8-15. Overall Block Diagram

A1 OPERATION

This assembly attenuates Channel A and B input signals by factors of 1, 10, or 100 with AC or DC coupling. Input mode is selected by COM-SEP switch S1. With S1 set to COM, Channel A and B are connected in parallel at the INPUT jack. When S1 is set to SEP, Channel A and B are independent.

A1 TROUBLESHOOTING

If assembly is not working, check other positions of ATTEN and AC-DC switches. When it has been determined what positions are not operating, the trouble may be traced to the specific resistor, capacitor, or switch.

A2, (A3) OPERATION

This circuit amplifies Channel A input signals from A1, gives marker output for oscilloscope intensity modulation, and drives function selector assembly A4. The circuit consists of an FET input differential amplifier, a differential Schmitt trigger, and an output one-shot MV. The differential amplifier, coupled with the differential Schmitt trigger, provide very accurate and stable triggering. The differential amplifier is balanced by R10 and is adjusted for maximum sensitivity at 20 MHz with a sinewave input and LEVEL control set to PRESET. SLOPE and LEVEL may be programmed from J8 (REMOTE PROGRAM connector) when Function Selector switch S5 is set to EXT. The LEVEL controls must be set to PRESET for remote programming.

Counter settings for waveforms:

SAMPLE RATE clockwise not OFF
FAST/NORM/HOLD NORM
TIME BASE/MULTIPLIER 1 SEC
Function Selector FREQ A
COM-SEP SF
CHANNEL A ATTEN X1
CHANNEL A AC-DC AC
CHANNEL A SLOPE +
CHANNEL A LEVEL PRESET
CHANNEL A INPUT connect 10 kHz at 100 mV
STORAGE ON

A2, (A3) TROUBLESHOOTING

The first thing to do is check all the DC voltages coming into the board (-12V at pins 6, 13 and +12V at pins 7, 8 and +5.1V at pin 15). Now check input signal at pin 1 (should be at least 100 mV rms, .28V p-p). Make waveform checks to determine which stage is not operating. When trouble has been isolated to a stage, make voltage and resistance measurements. DC voltages shown on Figure 8-12 are taken with no input signal, LEVEL control to PRESET, and SLOPE control to +.

A2, (A3) ADJUSTMENT

1. Set Counter controls as follows:

SAMPLE RATE . . . clockwise out of OFF
FAST/NORM/HOLD . . . FAST
TIME BASE/MULTIPLIER . . . 1 s
Function Selector . . . FREQ A
COM-SEP . . . SEP
CHANNEL A
ATTEN . . . X1
LEVEL . . . PRESET
STORAGE . . . ON
INT-EXT . . . INT

2. Connect 20.0 MHz at 0.1 V rms sinewave to CHANNEL A INPUT.

3. Adjust A2R10 for a stable count.

All waveforms taken with HP 175A Oscilloscope and HP 10003A 10:1 Divider Probe. Center line of graticule is zero volts.

WAVEFORM NO.	Oscilloscope Settings				
	SENS V/cm	AC	DC	SLOPE + -	SWEEP /cm
1	.05V	x		x	20 μ s
2	.05V	x		x	20 μ s
3	.1V	x		x	20 μ s
4	.05V		x		.2 μ s
5	.2V		x	x	.2 μ s
6	.5V		x	x	20 μ s

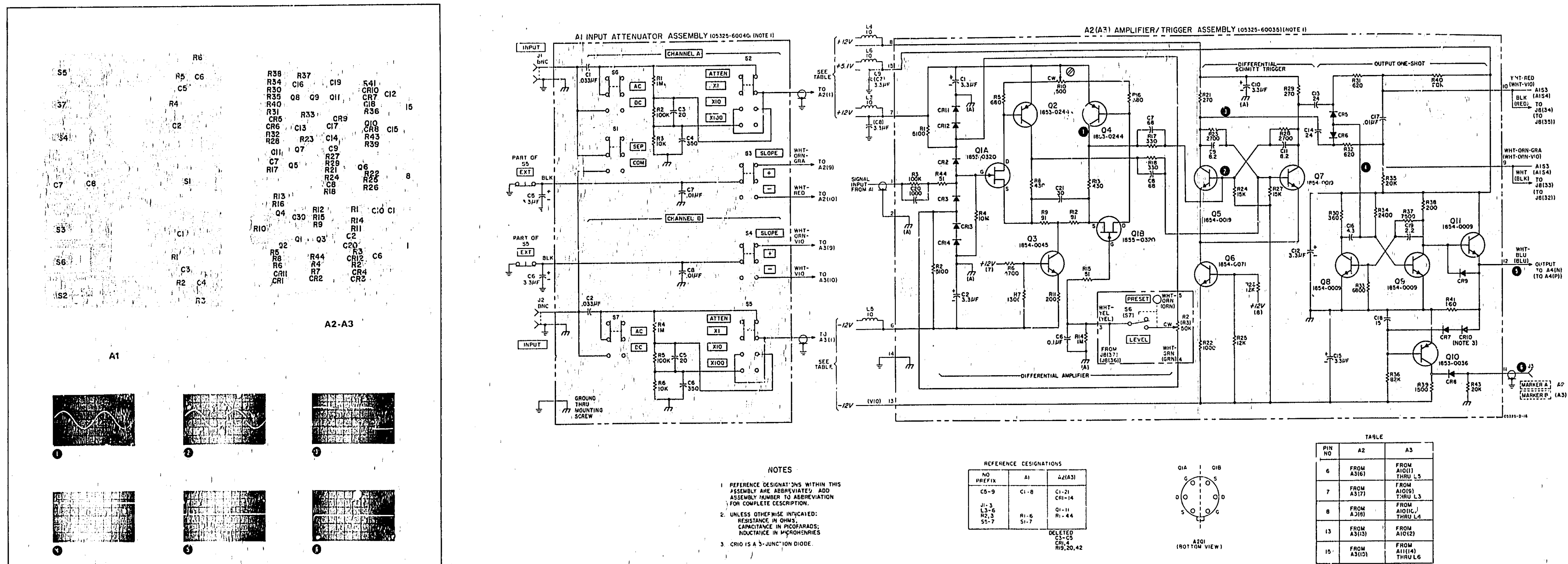


Figure 8-16. A1 Input Attenuator, A2 (A3) Amplifier/Trigger

A4 FUNCTION SELECTOR OPERATION

This assembly is an arrangement of gates that direct Channel A and B, time base, and 10 MHz clock signals. TIME BASE and GATE output are provided by IC8c and IC1d, respectively. This assembly may be programmed from J8 (REMOTE PROGRAM connector) when Function Selector S5 is set to EXT. Figures 8-2 through 8-8 show the signal path for various functions. The assembly has four AC signal inputs (Channel A, Channel B, time base, and 10 MHz clock signal) and eight DC control inputs (one for each function). The DC control signal is provided by Function Selector switch S5. When S5 is set to EXT, the DC control inputs come from J8 (REMOTE PROGRAM connector).

A4 TROUBLESHOOTING

Check operation of Counter in all functions to determine which function or functions are not operating. Check to see that "holdoff" or "reset" are not present all the time and causing the assembly to hang-up. Use flow diagrams, Figures 8-2 through 8-8, and waveforms to isolate trouble. Refer to Section IV for operation details of main gate F-F IC9. Check +5.1 V at pins 5 and E.

Use the following procedure to locate trouble in the function selector, A4.

- Switch Counter power OFF.
- On A8 Counter Board, disconnect reset (white-red-gray) and holdoff (white-orange-green) wires.
- A8, disconnect and ground inhibit (white-orange-yellow) wire.

d. Set Counter controls as follows:

Function Switch	CHECK
TIME BASE	.1 μ s
SAMPLE RATE pot	counterclockwise but on
SAMPLE RATE slide switch	FAST
CHANNEL A and B	
ATTEN	X1
AC-DC	AC
LEVEL	PRESET
SEP-COM	SEP
STORAGE	ON
INT-EXT	INT

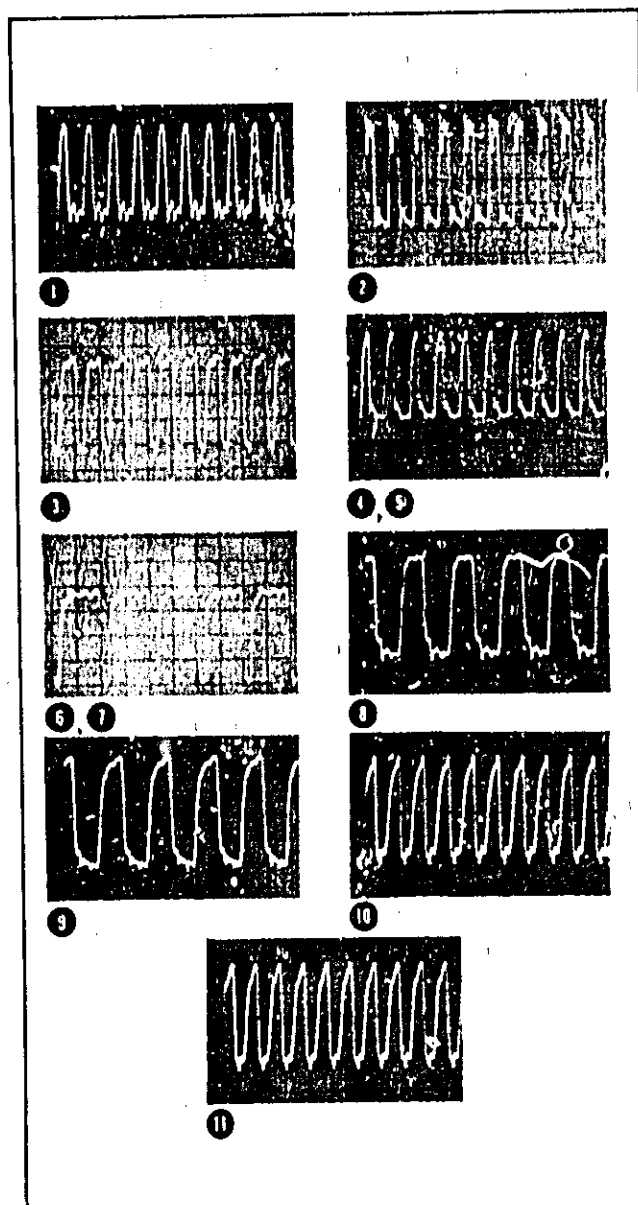
e. With an oscilloscope, check the 10 MHz through from pin M to pin S (see waveforms (2) and (10)). If the signal is present, the circuit through IC6 is OK. If the signal is absent, check the inputs to IC6; and check the inputs and outputs of IC3A, IC3B, and IC4C. If the IC6 inputs are correct but the output is not, replace IC6. If IC3 or IC4 inputs are correct but the outputs are not, replace the bad IC.

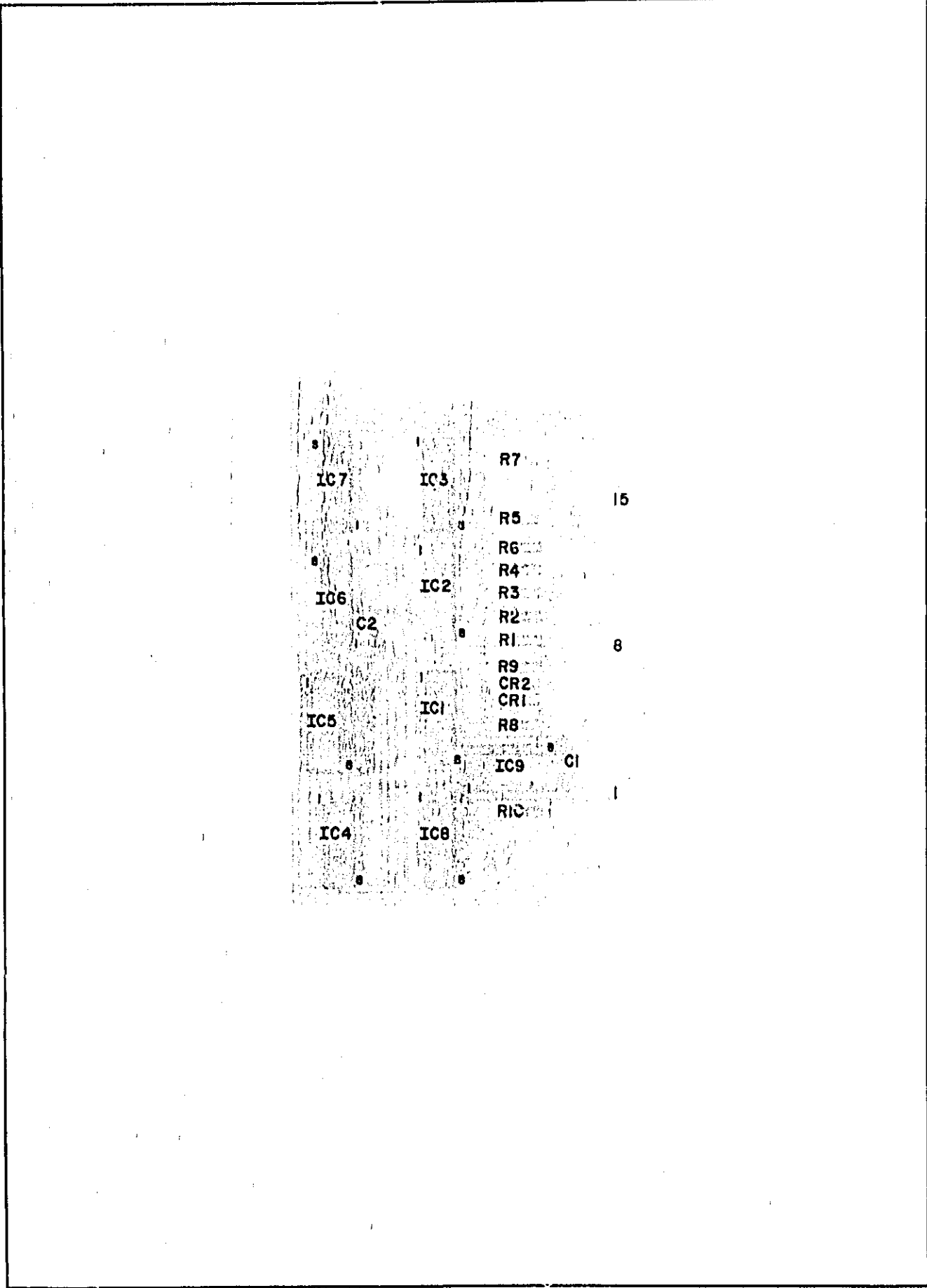
f. Check the 10 MHz through from A4 pin M to pin R (see waveforms (2) and (11)). If the signal is present, the circuit through IC7 is OK. If the signal is absent, check the inputs to IC7; and check the inputs and outputs of IC2B, IC3C, and IC3D. If the IC7 inputs are correct but the output is not, replace IC7. If the IC2

or IC4 inputs are correct but the outputs are not, replace the bad IC.

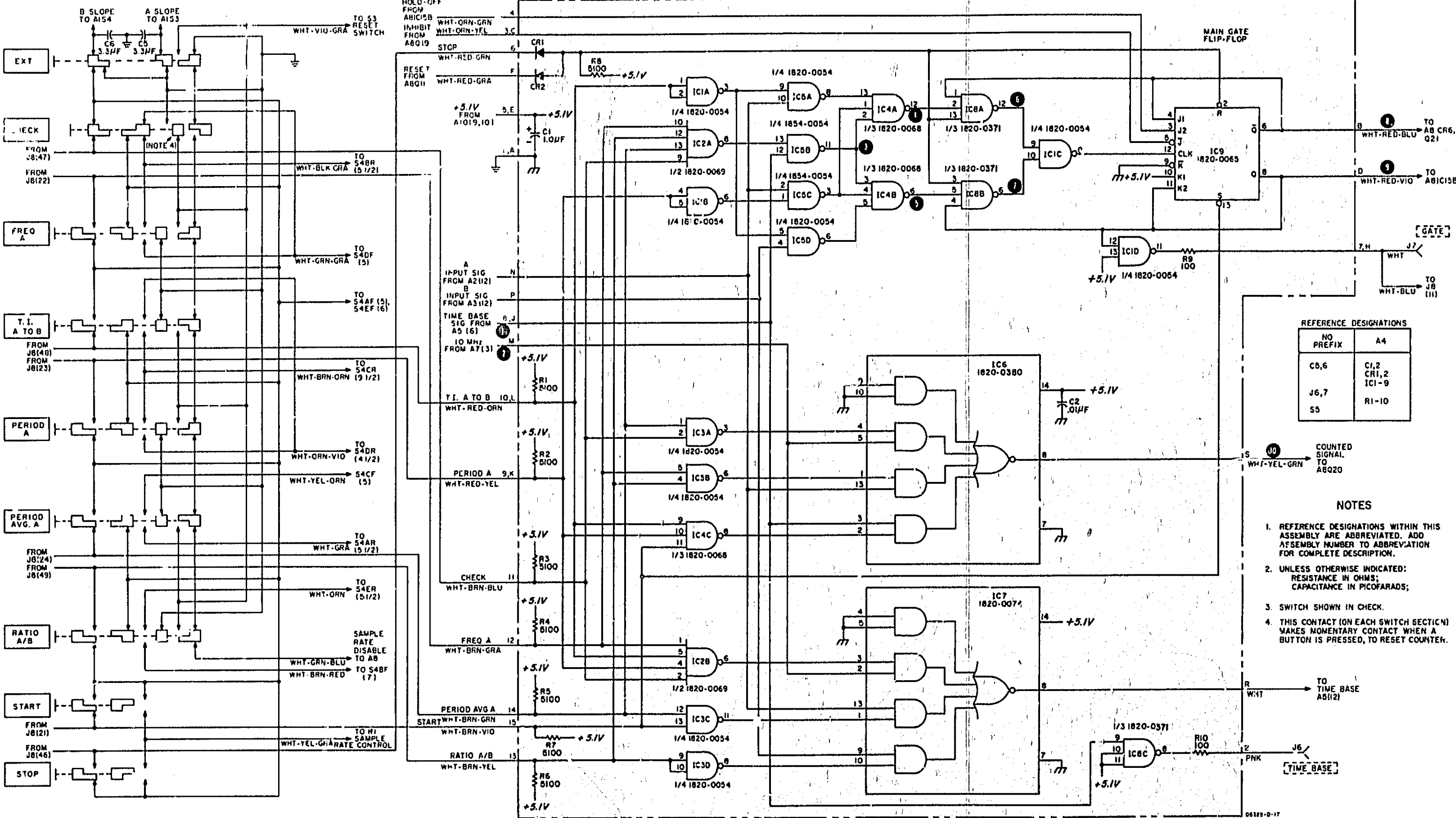
g. With an oscilloscope in vertical DC coupling, check the 10 MHz (or 5 MHz) signal through from pin 8-J (see waveform (1)) to pins B and D (see waveforms (8) and (9)). If the correct signal is present the circuit is OK. If the signal is absent check the input and output to IC1A, IC2A, IC1B, IC5A, IC5B (see waveform (3)), IC6C, IC6D, IC4A, IC4B (see waveforms (4) and (5)), IC8A, IC8B (see waveforms (6) and (7)), IC1C, and IC9. If the IC9 inputs are correct but the output is not, replace IC9. (IC9 is plug-in mounted to permit checking by substitution.) If the Counter operates OK in some functions but not others, the IC gates in the function selector should be checked.

Used for these waveforms: HP Model 180A Oscilloscope with 1801A Dual Channel Vertical Amplifier and 1820B Time Base. Settings - vertical: 1 volt/cm and horizontal: 1 μ sec/cm.





S5 FUNCTION SELECTOR SWITCH (NOTE 3)



NO. PREFIX	A4
C0,6	C1,2
J6,7	C1,2
S5	R1-10

- NOTES
1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
 2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS; CAPACITANCE IN PICO FARADS.
 3. SWITCH SHOWN IN CHECK.
 4. THIS CONTACT (ON EACH SWITCH SECTION) MAKES MOMENTARY CONTACT WHEN A BUTTON IS PRESSED, TO RESET COUNTER.

Figure 8-17. A4 Function Selector

A5 TIME BASE OPERATION

The A5 Time Base assembly receives the 10 MHz A7 oscillator signal or the CHANNEL A or B INPUT signal through the A4 function selector. Depending on the setting of the TIME BASE/MULTIPLIER switch S4, the A5 input signal is passed through without division, or it is divided by 10 to 10^8 . This assembly may be programmed from J8 (REMOTE PROGRAM connector) when Function Selector switch S5 is set to EXT.

DUAL DECADE DIVIDERS

IC's 1 to 4 are dual section (A and B) decade dividers, cascaded to divide inputs by 10^1 to 10^8 . SECTION A. For 10 pulses in pin 2, 1 pulse exits pin 4. When pin 14 goes low, grounded by TIME BASE/MULTIPLIER switch, the divided by 10 output is also at pin 13. When pin 16 is high the decade is reset to 0. When the EXT pushbutton (S5) is depressed, the DC control lines to the decade dividers are controlled from the REMOTE PROGRAM connector, J8. SECTION B. Section B duplicates A (see IC diagram for pins).

A5 TROUBLESHOOTING

If Counter operates in one or more positions of the TIME BASE/MULTIPLIER switch, one of the decade dividers (IC1 through IC8) is probably bad. If there is no output from pin 6 in any position of the TIME BASE/MULTIPLIER switch, check input signal at pin 12. Next, check the DC voltage at pins 13 and 15 to see if "inhibit" or "reset" is present and causing the assembly to lock up. Check +5.1 V at pin 4, and make waveform measurements.

Use the following procedure to locate trouble in the Time Base, A5.

- Switch power OFF.
- On A8 Counter Board, disconnect and ground inhibit (white-orange-yellow) wire.

c. Set Counter controls as follows:

Function, Switch	CHECK
TIME BASE	.1 μ s
SAMPLE RATE pot	counterclockwise but on
SAMPLE RATE slide switch	NORM
CHANNEL A and B	
ATTEN	X1
AC-DC	AC
LEVEL	PRESET
SEP-COM	SEP
STORAGE	ON
INT-EXT	INT

d. With an oscilloscope, check A5 pin 6. (This is the time base output at .1 μ s TIME BASE switch setting.) Waveform (6) is the correct display (10 MHz).

If the waveform is absent or wrong, continue checking the next steps.

e. Check the waveform at A5 pin 12. (This is the time base input.) Waveform (1) is the correct display. If this waveform is absent, refer to function selector, A4, schematic diagram and troubleshooting. If waveform (1) is OK, continue step (f).

f. Check the waveform at IC1 pin 2. Waveform (2) is the correct display. If the waveform is absent or wrong, check transistors Q1, Q2, Q3, and Q4. If waveform (2) is OK, continue with step (g).

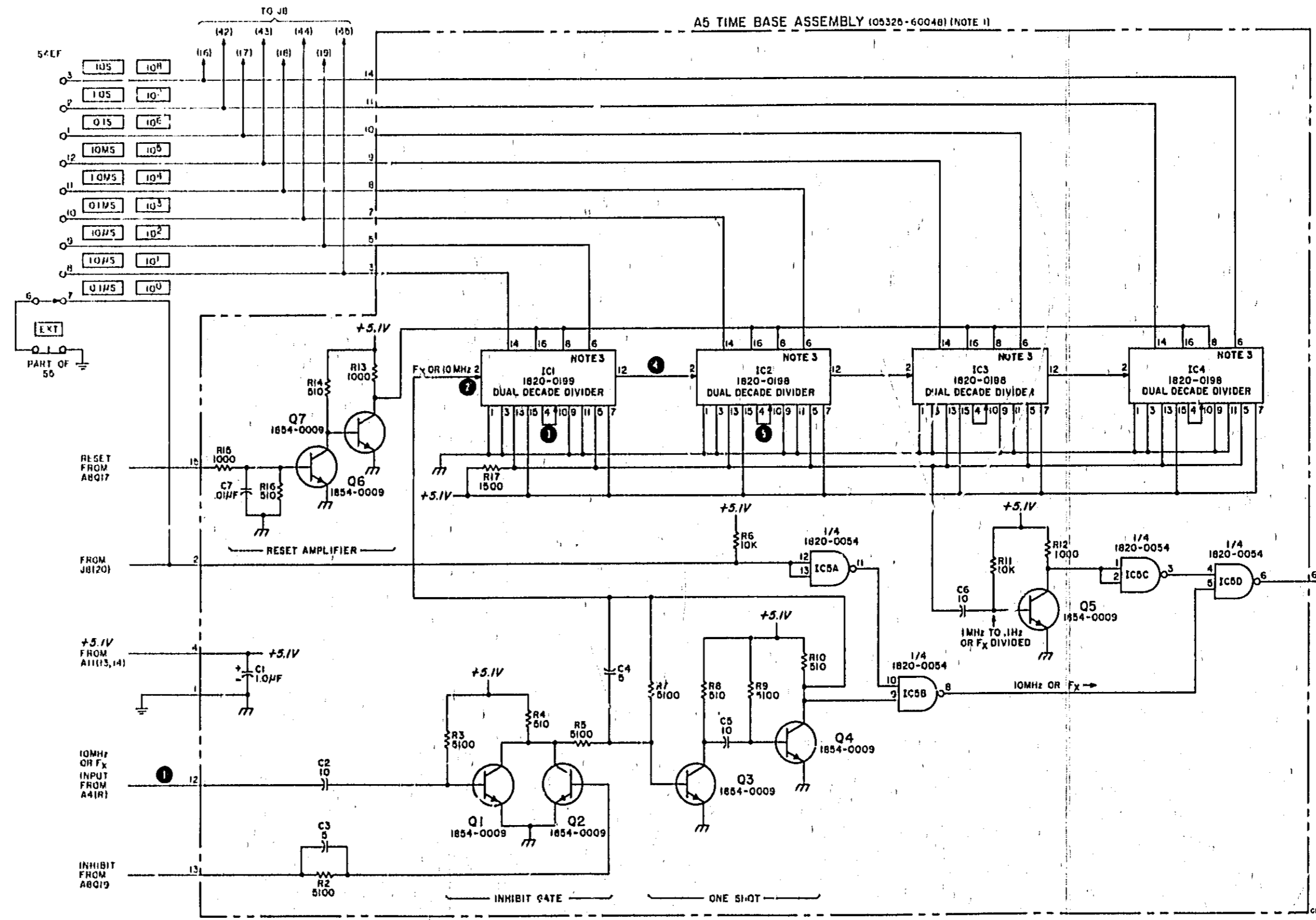
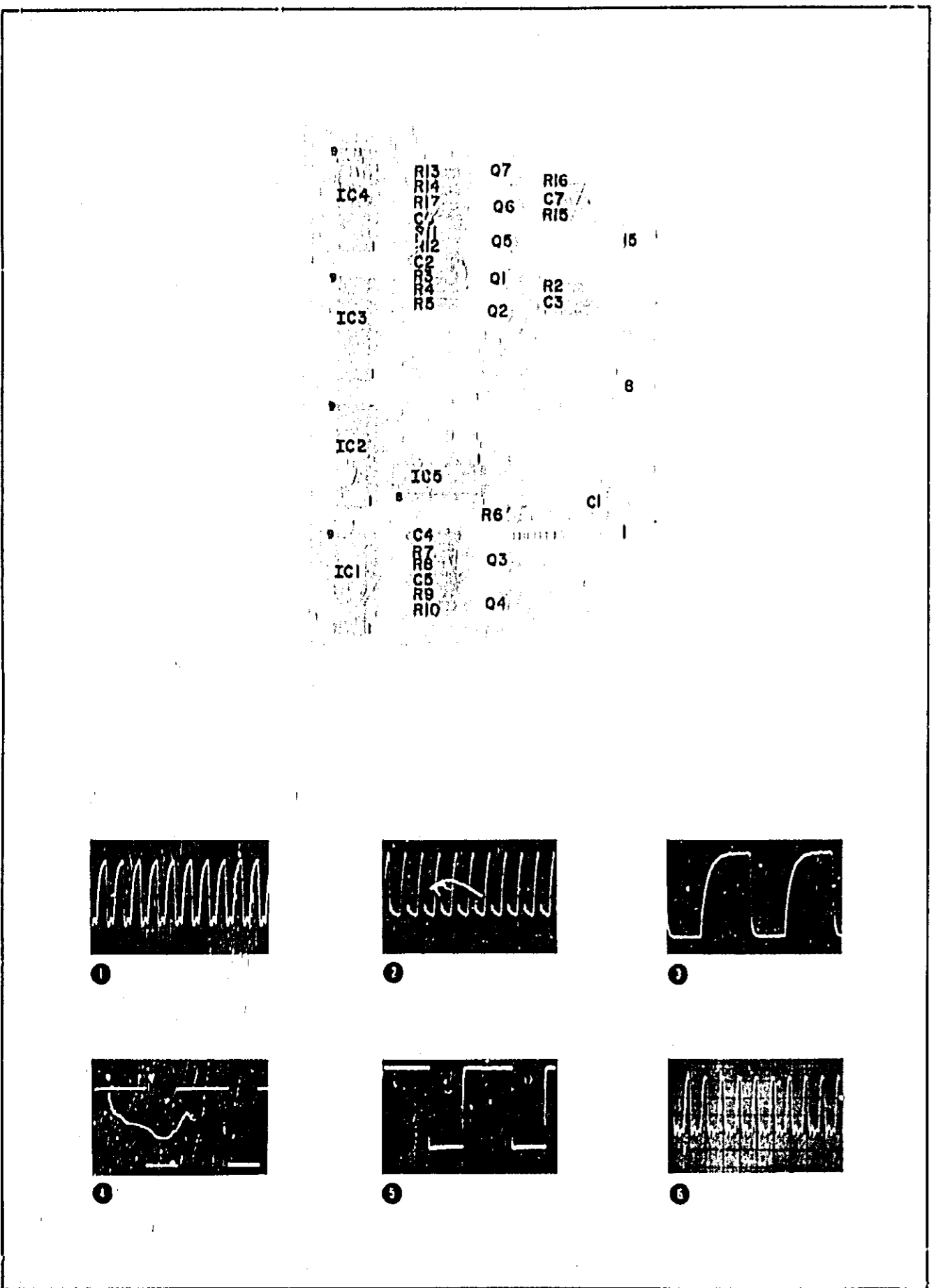
g. Check the waveform at IC1 pin 4. Waveform (3) is the correct display. If the waveform is absent or wrong check IC1. If the waveform is OK, continue with step (h).

h. Check the waveforms in sequence at pins 4 and 12 of IC2, IC3, and IC4 changing the oscilloscope time base to get waveform (4) or (5). If the waveform is absent at any one and following points, check the associated IC.

Used for these waveforms: HP Model 180A Oscilloscope with 1801A Dual Channel Vertical Amplifier and 1820B Time Base.

A 10:1 divider probe was used with .1 V/cm vertical sensitivity setting giving 1 V/cm on screen.

Model 5325B



- NOTES
1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
 2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS; CAPACITANCE IN PICOFARADS;
 3. SEE FIGURE 8-1, 1820-0198, 1820-0199

REFERENCE DESIGNATIONS	
NO PREFIX	A5
	C1-7
	IC1-5
	Q1-7
	R2-17
54, 5	

Figure 8-18. A5 Time Base
8-27

A6 OPERATION

This assembly contains the 10 MHz crystal for oscillator/multiplier assembly A7, and heater RT1 which maintains crystal temperature. The heater operates on 24 volts (+12V and -12V supplied by A10).

A6 TROUBLESHOOTING

If oscillator frequency will not stay within specified limits, it may be due to a faulty heater. Check resistance of RT1 (should be 60 to 80 ohms at room temperature). If heater checks ok, replace crystal.

A7 OPERATION

The 10 MHz oscillator assembly consists of oscillator U1A, buffer U1B, and level shifter Q2. U1A operates as an amplifier with positive feedback from the non inverted output of U1A(6) through the 10 MHz crystal (05326-60012) and trimmer capacitors C1 and C2 to U1A(4). Negative feedback through R1 and R5 is used to establish the input bias for U1A. C4 filters out the noise.

The inverted output of U1A(5) connects to buffer U1B(10) and this provides isolation between the oscillator and the output. The outputs of U1B(8) and (9) switch from approximately 3.5V to 4.3V, when one output is 3.5V, the other is 4.3V. Level shifter Q2 converts the output of U1B to a signal of approximately 0 to +4 volts.

When the INT/EXT switch is in INT, U2A(2) is high and the oscillator is routed through U2A and U2B to A4. This signal is also routed through buffer 2D to the OSC BNC connector.

When the INT/EXT switch is in EXT, U2A is inhibited and the external oscillator is fed into the Schmitt trigger Q1/Q3, which feeds buffer U2C and U2B. R2 and CR1 furnish overload protection and triggering stability. L1, C5, and C6 provide filtering for power supply noise.

A7 TROUBLESHOOTING

Measure the supply voltages and verify that INT/EXT switch is in INT. Check for the oscillator signal at U1A(6), U1B(8), U1B(9), Q2 collector, U2A(3), and U2B(11).

A7 ADJUSTMENT

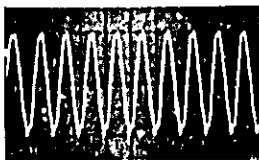
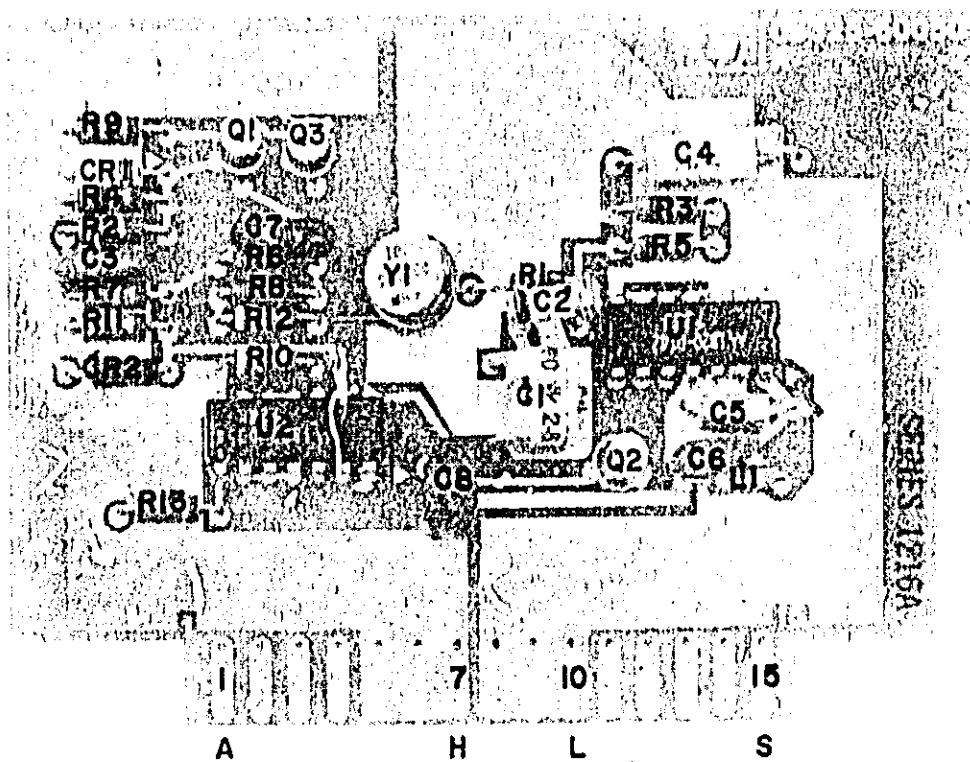
Set counter controls as follows:

SAMPLE RATE mid position
FAST/NORM/HOLD FAST
TIME BASE 10 s
FUNCTION FREQ A
CHANNEL A X1, DC, SLOPE
LEVEL PRESET

Operate counter for 30 minutes with all covers in place for temperature stabilization. Connect a 1 MHz standard to INPUT A and adjust A7C4 (accessible through the right side-cover), for an all-zero display. Allow ten seconds between adjustments for counter to make measurement.

All waveforms taken with HP 175A Oscilloscope and HP 10002A 50:1 Divider Probe. Center line of graticule is zero volts.

WAVEFORM NO.	Oscilloscope Settings					
	SENS V/cm	AC	DC	SLOPE		SWEEP /cm
				+	-	
1	.005V	x			x	.1 μs
2	.02V	x			x	.1 μs
3	.02V		x	x		.1 μs
4	.05V		x		x	.1 μs
5	.05V		x	x		.1 μs
6	.02V		x		x	.1 μs



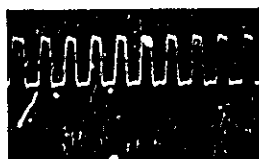
1



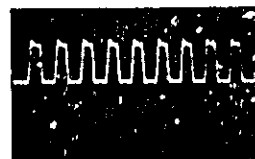
2



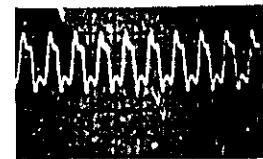
3



4



5



6

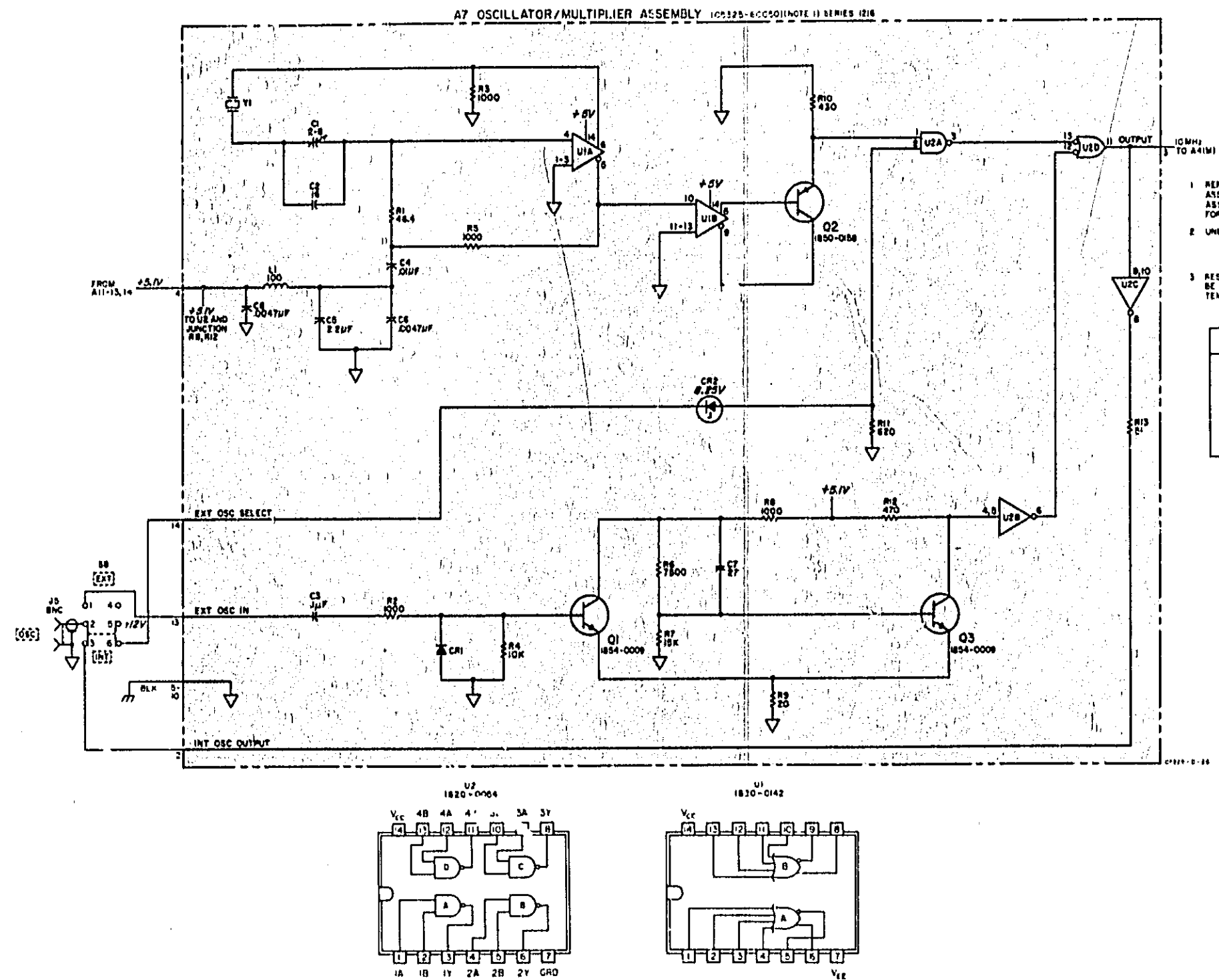


Figure 8-19. A6 Crystal/Oven
A7 Oscillator/Multiplier

A8 OPERATION

GENERAL. This portion of the assembly contains circuits for: GATE and OVERFLOW lights, sample rate, print command, transfer, and reset. See timing diagram, Figure 4-6.

GATE LIGHT. The GATE light indicates when main gate Q20-Q21 is open. Gate light driver Q2 receives input from main gate F-F A4IC9 (located on function selector assembly A4) and gate light one-shot Q5 and Q6. During short gate times, the gate light one-shot ensures a visible flash from the GATE light. However, during short sample rate periods, the GATE light will appear to be on all the time due to the time delay in the gate light one-shot.

OVERFLOW LIGHT. The OVERFLOW light indicates when the last decade counter (IC7) has exceeded 9 counts. A positive pulse appears at IC7 (8) when it changes from 9 to 0. This signal is received by Q9 and triggers NAND gate F-F IC18c, d. When the transfer pulse occurs, a positive pulse is applied to IC18a(5) and IC18b(9). This signal permits NAND gate F-F IC17c, d to assume the state of the preceding F-F (IC18c, d), and OVERFLOW light is turned on. After the sample rate period, a reset pulse is applied to the first NAND gate F-F to set it for the next cycle.

SAMPLE RATE. When the main gate closes at end of gate time, IC15b is triggered. IC15b(10) goes low and applies holdoff to main gate F-F A4IC9 (located on function selector assembly A4). Pin 10 also drives the main gate and time base inhibit circuit Q18 and Q19. IC15b(11) goes high and provides clock input for IC15a, if printer inhibit is not present. When IC15a is triggered, pin 15 goes high and turns on Q10 and Q13. This gives print command and starts sample rate run-down circuits. IC15a(14) goes low and triggers transfer one-shot. At end of sample rate period, IC15a, b are reset by IC16d. When IC15a and b are reset, they trigger reset one-shot Q11, 12, and 14.

PRINT COMMAND. When main gate Q20-Q21 closes at end of gate time, Q10 is turned on and provides a +5 V to 0 V step (print command signal) at A8J2(D).

TRANSFER. The transfer one-shot mV is triggered when IC15a(14) goes low at end of gate time. When triggered, IC16b(8) goes high and releases information in overflow storage circuits. Also at this time, IC17b(3) goes low and transfers the count from decade counters IC1 through IC7 to buffer storage units IC8 through IC14.

RESET. After sample rate period, the reset one-shot is triggered by IC15a and b. At this time, A14 collector goes high and turns on reset amplifier Q17. Q17 resets decade counters IC1 through IC7 to zero, and time base dividers A5IC1 through A5IC8 (located on time base assembly A5) to nine. At the same time, Q11 collector goes low and resets overflow NAND gate F-F IC18c, d, and main gate F-F A4IC9.

The reset one-shot is also triggered (via reset trigger circuit Q7 and Q8) when RESET button S3 is pressed or when Function Selector switch S5 is switched from one function to another.

A8 TROUBLESHOOTING

Use front and rear panel controls to determine which section of the board is not working. Measure all DC voltages coming into the board, check for loose connections at clip-on wires, and make waveform measurements. See Section IV for operation details of sample rate F-F IC15 a and b. Refer to Paragraph 5-15 for board removal procedure. When replacing board, be sure clip-on wires are connected correctly.

WARNING

USE EXTREME CAUTION WHEN TROUBLESHOOTING THIS ASSEMBLY AS +175 VOLTS IS PRESENT AT MAIN POINTS ON BOARD.

Use the following procedure to check the sample rate F-F number one (IC15B):

- Switch Counter power OFF, and remove top and bottom covers.
- Disconnect reset (white-red-gray) and holdoff (white-orange-green) wires from board.
- Disconnect and ground inhibit (white-orange-yellow) wire.
- Set Counter controls as follows:

Function Switch	CHECK
TIME BASE	1 μ s
SAMPLE RATE pot	Full CCW (but not OFF)
SAMPLE RATE slide switch	FAST
STORAGE	ON

- Check IC15 pin 6 with oscilloscope. The correct waveform is a 5 MHz square wave. If the 5 MHz signal is absent, refer to A5 time and A4 function selector.

- Check IC15 pins 10 and 11 with oscilloscope. The correct waveform is number (1).

If only one of the two signals at IC15 pin 10 or 11 is correct, replace IC15. If neither signal at IC15 pin 10 or 11 is correct, check preceding circuits.

Use the following procedure to check the sample rate F-F number two (IC15A):

- Repeat steps (a) through (d) above.
- With oscilloscope or logic probe check IC15 pin 1. Pin 1 should be low.
- Press the Counter RESET switch, and IC15 pin 1 should go high. If pin 1 stays low check IC16 pin 4; it should be high. If IC16 pin 4 is high and IC15 pin 1 stays low, replace IC16. If IC16 pin 4 is low, check Q4 the printer inhibit amplifier.

- Check IC15 pin 3 when RESET button is pressed; pin 3 should go low and change back to high when RESET is released. If IC15 pin 3 levels are wrong, check the reset circuit.

- Check IC15 pins 14 and 15 when RESET button is pressed; pin 15 should go low and pin 14 should go high when RESET is released. If IC15 pins 14 and 15 levels are wrong, replace IC15.

Use the following procedure to check the sample rate and reset circuit:

- Switch Counter power OFF.
- On A8 Counter Board, disconnect the two main gate wires (white-red-violet and white-red-blue).
- Set the Counter controls as follows:

Function Switch	STOP
TIME BASE	1 μ s
SAMPLE RATE slide switch	NORM
CHANNEL A and B	
ATTEN	X1
AC-DC	AC
LEVEL	PRESET
SEP-COM	SEP
STORAGE	ON
INT-EXT	INT

- Check each of the test points listed in Table 8-1, with RESET button pressed and then released.

Table 8-1. Reset-Sample Rate Troubles

Test Point	RESET Pressed	RESET Released	If Indication is wrong check
CR5 anode	0 V	+1.4 V	RESET switch
Q7 collector	+ .7 V	+ .2 V	Q7 or CR7
Q8 collector	+ .2 V	.5 V	Q8
CR11 anode	+ .85 V	+1.4 V	CR11
Q14 collector	High	Low	Q14, CR13
Q11 collector	Low	High	Q11, Q12
Q12 emitter	Low	High	Q11, Q12
Q17 emitter	High	Low	Q17
IC15 pins 3 and 8	Low	High	CR16
IC15 pins 11 and 15	Low	--	IC15

- Set the Counter controls as follows:

Function Selector	CHECK
TIME BASE	1
SAMPLE RATE pot	Full clockwise

- Check the waveforms at Q13 collector 4 and Q16 emitter 5 when the RESET button is pressed and released. Waveforms 4 and 5 are the correct display. If the Q13 collector waveform is wrong, check Q13. If the Q13 collector waveform is correct but the Q16 emitter waveform is wrong check Q15 and 16.

- Check the voltage at IC16 pin 3.

- Hold the RESET button in. The IC16 pin 3 voltage should be high. Release the RESET button and in 5 to 10 seconds pin 3 should go low. If IC16 pin 3 stays high, check IC16.

- Check the voltages at IC15 pins 3 and 8. If these voltages do not follow IC15 pin 3, replace CR17.

Use the following procedure to check the transfer circuit:

- Switch Counter power OFF.

Section VIII Circuit Diagrams

- Set Counter controls as follows:

Function Switch	CHECK
TIME BASE	1 s (second)
SAMPLE RATE slide switch	NORM
CHANNEL A and B	
ATTEN	X1
AC-DC	AC
LEVEL	PRESET
SEP-COM	SEP
STORAGE	ON
INT-EXT	INT
SAMPLE RATE pot	for display time of one second.

- With a logic probe or oscilloscope check level at IC15 pin 14. It should alternate high and low for about one-second at each level.

- With a logic probe or oscilloscope check the level at IC16 pin 10. It should alternate high and low for about 1/10-second low and 1-second high. If these levels are wrong, check C7.

- With a logic probe or oscilloscope check the level at IC16 pin 8. It should alternate high and low for about 1/10-second high and 1-second low. If these levels are wrong, check IC16.

- With a logic probe or oscilloscope check the level at IC17 pin 3. It should alternate high and low for about 1/10-second low and 1-second high.

- Set Counter STORAGE switch OFF. Check IC17 pin 3; it should be low and pin one should be high. If only pin 1 is correct (high), check IC17. If neither pins 3 and 1 or IC17 are correct, check IC16 pin 9. If IC16 pin 9 is low, check IC16. If IC16 pin 9 is high, check Q3 and CR1.

Use the following procedure to check the inhibit circuit:

- Switch Counter power OFF.

- Set the Counter controls as follows:

Function Switch	CHECK
TIME BASE	1 μ s
SAMPLE RATE slide switch	FAST
CHANNEL A and B	
ATTEN	X1
AC-DC	AC
LEVEL	PRESET
SEP-COM	SEP
STORAGE	ON
INT-EXT	INT
SAMPLE RATE pot	counterclockwise but on

- With oscilloscope (vertical: 2 V/cm and sweep: 20 μ second/cm) check the waveform at the A8 inhibit wire connection 9 (white-orange-yellow), and at the same time check the Q13 collector 4 waveform. The lower waveform is the correct inhibit display, and the upper waveform is the correct Q13 display.

The positive pulse width should be about 100 microseconds, and the negative pulse width should be about 5 microseconds plus the TIME BASE switch setting. Check the negative pulse width in the TIME BASE

switch 1 μ s and 10 μ s positions. If the inhibit waveform is absent, check the waveform at C16-R44 junction 8. The correct display is waveform 8. If the C16-R44 waveform is correct but the inhibit waveform is absent, check Q18 and Q19.

- If the C16-R44 waveform is absent, check IC17 pins 4 and 5. Waveforms at X6 and 7 are the correct display for IC17 pins 4 and 5. If the IC17 pins 4 and 5 waveforms are correct, check IC17. If the IC17 pin 4 is wrong check the reset circuit. If the IC17 pin 5 waveform is wrong, check IC15.

Use the following procedure to check the GATE light circuit:

- Switch Counter power OFF.

- Set Counter controls as follows:

Function Switch	CHECK
TIME BASE	1 s
SAMPLE RATE slide switch	NORM
SAMPLE RATE pot	2/3 clockwise (for the GATE light to flash about one second on and one second off)

If the GATE light will not flash off and on at about one second intervals, disconnect the A8 main gate signal wire (white-red-blue); and connect a wire from this A8 pin to ground. The GATE light should be on continuously. Remove the ground and the GATE light should go off. If the GATE light does not go on and off with the main gate pin grounded and open, check the voltage at A9P1(A). The A9P1(A) voltage should be about 90 volts with a ground on A8 white-red-blue pin and about 2 volts or less with A8 white-red-blue pin open. If the voltage at A8 white-red-blue pin stays high or low, check A8Q2. If the A9P1(A) voltage is greater than 100 volts, check DS8.

- To check GATE light drive, measure the voltage at A8CR6 anode with A8 white-red-blue pin open. It should be about +3.2 volts. If the voltage is less than +2.8 volts, check Q2. If the CR6 anode voltage is about +3.5 volts, check Q2 and CR4. If the CR6 anode voltage is less than +1 volts, check the collector of Q5. If the Q5 collector is less than .3 volt, check the base of Q6. If Q6 base is high and Q5 collector is low, replace Q5. If Q6 collector is high, replace Q6.

- For a check of the GATE light one-shot MV, set the Counter controls as follows:

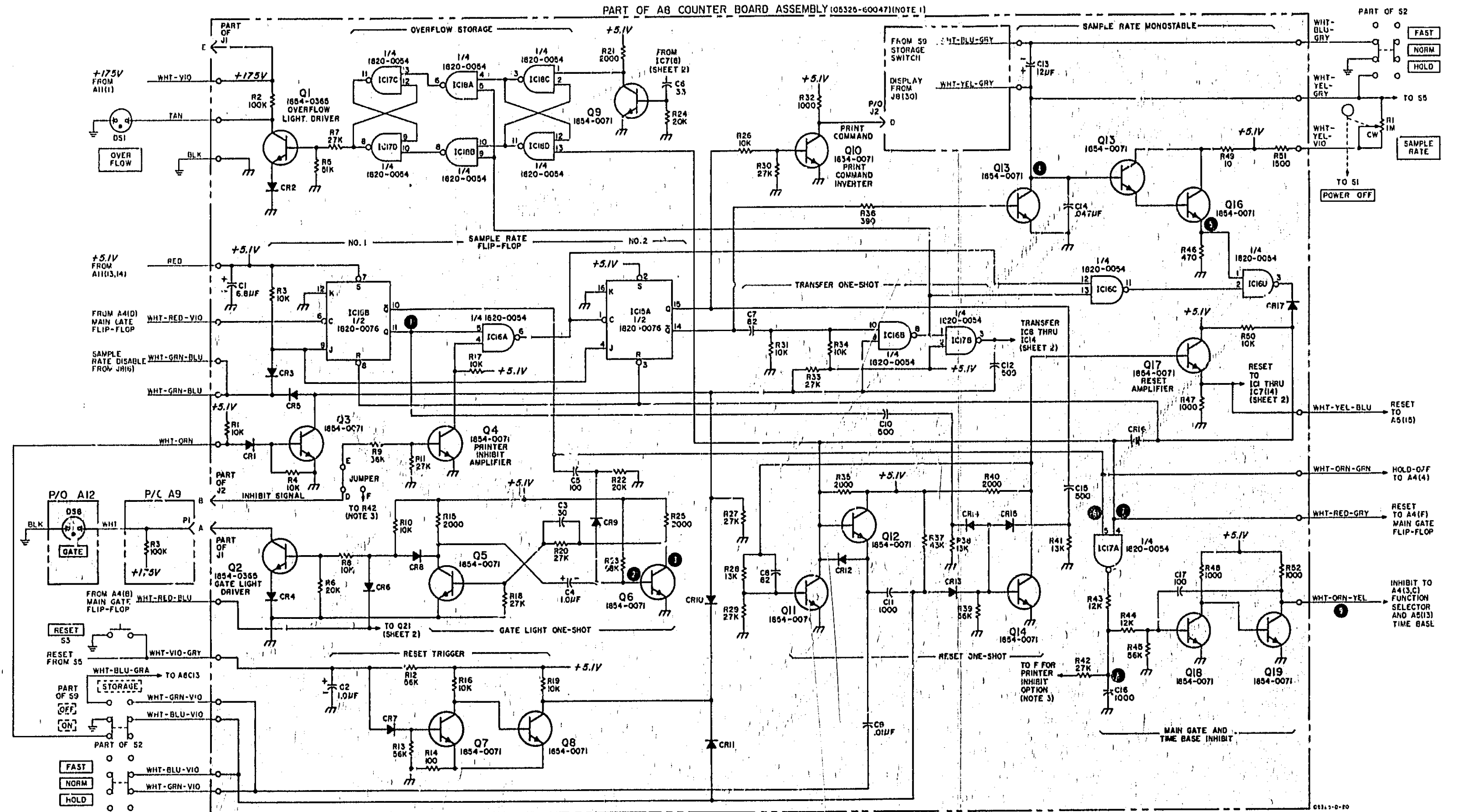
TIME BASE	1 μ s
SAMPLE RATE slide switch	NORM
SAMPLE RATE pot	about 2/3 clockwise

- Check the Q6 base 2 and collector 3 waveforms with SAMPLE RATE full clockwise. The correct waveforms are 2 and 3. If the waveforms are wrong, replace Q5 or Q6 as determined by the following conditions:

If Q6 base goes low and collector stays low, replace Q6. If Q6 collector goes high but does not remain high for 50 to 100 milliseconds replace Q5.

Figure 8-10

A6 CRYSTAL/OVEN
A7 OSCILLATOR/MULTIPLIER



8-31

AB OPERATION

GENERAL. This portion of the assembly contains main gate Q20 and Q21, blanking encoder circuits, decade counters (IC1 through IC7), and buffer storage circuits (IC8 through IC14).

MAIN GATE. Q20-Q21 make up a two-input AND gate. When Q21 base goes low, the transistor is cut-off and gate is open. Now, pulses at Q21 base will appear at the collector (gate output). From here, the pulses pass on to driver Q22, Q23, and decade counters.

BLANKING ENCODERS. Pin 10 of each decade counter is controlled by its respective blanking encoder circuit, IC19-IC20. IC19 and IC20 are identical six-section inverters. In this circuit the inverters provide blanking of the display zeros to the left of the significant digit. Each circuit receives input from TIME BASE/MULTIPLIER switch S4 (which works in conjunction with Function Selector switch S5) or REMOTE PROGRAM connector J8, and the preceding encoder circuit.

For example, with TIME BASE/MULTIPLIER switch S4 set to 10 s, and Function Selector switch S5 set to PERIOD AVG A, IC20(11), inverter E, will go low and the inverter E output will go high. This will allow the display tube for IC6 to be unblanked and at the same time will couple the signal to the preceding blanking encoder circuit, inverter D through inverter B.

DECADE COUNTERS. When main gate is open, IC1 through IC7 count the number of pulses and provide a four-line BCD code to buffer storage circuits. When pin 10 of decade is low, display tube for that decade is blanked.

Decade counter IC1 is a high-speed (greater than 10 MHz), non-blanking decade. All decade counters receive input on pin 9 and supply a divide-by-10 output on pin 8. The decades provide -8421 (DCBA) BCD output to buffer storage circuits. Refer to Table 8-2.

Table 8-2. Decade Counter Output

H = High (> 1.5V), L = Low (< 0.4V)

Digit	Pin Number			
	16	2	1	15
Blank	L	L	L	L
0	H	H	H	H
1	H	H	H	L
2	H	H	L	H
3	H	H	L	L
4	H	L	H	H
5	H	L	H	L
6	H	L	L	H
7	H	L	L	L
8	L	H	H	H
9	L	H	H	L

Section VIII
Circuit Diagrams

BUFFER STORAGE CIRCUITS. These circuits have four inputs and eight outputs. Four of the output lines carry coded information to the decoder drivers on display board assembly A0. The other four outputs are -8421 BCD code for DIGITAL RECORDER connector on rear panel. When STORAGE switch S9 is ON, pin 5 of buffer storage circuits is held high. This prevents information in decade counters from reaching the buffer storage circuits. When the transfer pulse occurs, pin 5 goes low, and information in the decade counters passes through buffer storage circuits and on to decoder drivers on display board A0. Refer to Table 8-3.

Table 8-3. Buffer Storage Output

H = High (> 2.1V), L = Low (< 0.4V)

Digit	Pin Number			
	16	3	1	14
Blank	L	L	L	L
0	H	H	H	H
1	H	H	H	L
2	H	H	L	H
3	H	H	L	L
4	H	L	H	H
5	H	L	H	L
6	H	L	L	H
7	H	L	L	L
8	L	H	H	H
9	L	H	H	L

AB TROUBLESHOOTING

Measure all DC voltages coming into the board, check for loose connections at clip-on wires. Refer to Paragraph 5-15 for board removal procedure. When replacing board, be sure clip-on wires are connected correctly.

WARNING

USE EXTREME CAUTION WHEN TROUBLESHOOTING THIS ASSEMBLY AS +175 VOLTS IS PRESENT AT MANY POINTS ON BOARD.

Use the following procedure to locate trouble in the counting section of the Counter Board, AB.

- a. Switch power OFF.
- b. Connect the Counter rear panel OSC receptacle to the front CHANNEL A INPUT receptacle with a coaxial cable.

c. Set the Counter controls as follows:

Function Switch	START
TIME BASE	.1 μ s
SAMPLE RATE slide switch	NORM
CHANNEL A and B	
ATTEN	X1
AC-DC	AC
LEVEL	PRESET
SEP-COM	SEP
STORAGE	ON
INT-EXT	INT
SAMPLE RATE pot	on but counterclockwise

NOTE

The nixie® display will show numerals changing continuously. The left digit will change at 1/10-second intervals and the others are changing at shorter times.

d. With an oscilloscope check the test points listed below for the signals listed:

Test Point	Correct Signal (Square Wave)
Q20-Q21 Collectors	10 MHz
Q22 Collector	10 MHz
Q23 Collector	10 MHz
IC1 pin 8	1 MHz
IC2 pin 8	1.0 kHz
IC3 pin 8	1.0 kHz
IC4 pin 8	1 kHz
IC5 pin 8	100 Hz
IC6 pin 8	10 Hz
IC7 pin 8	1 Hz

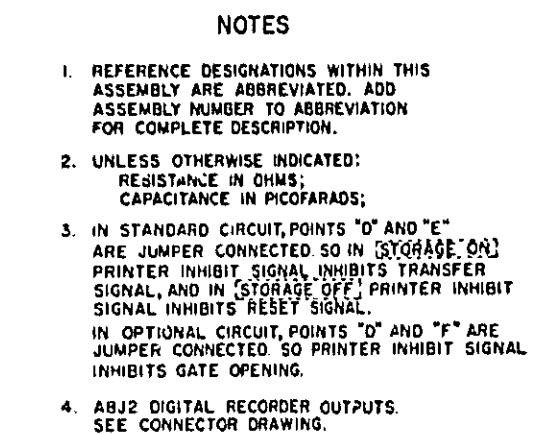
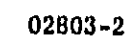
If any signal is absent check the associated IC.

e. Press the STOP button. Check the decade counters output (IC1 to IC7) with Table 8-2, and check the buffer storage output with Table 8-3. The decade counters, buffer storage, and nixie® display tubes should agree. The buffer storage printer output pins (2, 4, 13, 15) should be opposite of the display (1, 3, 14, 16). All possible combinations for each digit can be checked by pressing the START and STOP buttons to change the display.

f. If one display nixie® is suspected to be showing a wrong digit, press the START button and set the TIME BASE switch so the suspected nixie® changes once per second. Press the STOP button when the suspected digit should be on. Check the associated decade counter and buffer storage for correct output. If the decade and buffer are OK, the nixie® driver or nixie® may be bad. Switch nixie® tubes to check them. Replace the decoder driver IC if necessary.

If the unused zeros are not blanking correctly, check the blanking inverters (IC19 and IC20). The inverter should send a low to pin 10 of each decade (IC1 to IC7) that should be blanked.

Figure 8-20
AB COUNTER BOARD
(Sheet 1 of 2)
8-31



REFERENCE DESIGNATIONS			
NO PREFIX	A8	A9	A12
DS1	CI-22 CR1 23		DS6
	ICI-20 J1,2	PI	
	Q1-23 R1-60	R3	
S2,3,9			

Figure 8-20. A8 Counter Board
(Sheet 2 of 2)

A9 OPERATION

This assembly includes decoder drivers IC1 through IC7 and digital display tubes DS1 through DS7. Break-down diodes CR8 and CR9 clamp the B+ voltage to digital display tubes. The decoder drivers receive -8421 (DCBA) BCD code from buffer storage circuits on A8. This information is deciphered within the unit and provides an output to one of the display tube elements (0, 1, 2, etc). A low (about +2V) to an element of the display tube will light that number. Numbers which are not lighted are held high (about +85V). The digital display tubes also contain decimal points. Refer to Table 8-4.

A9 TROUBLESHOOTING

Check DC voltages coming into the board (+5.1V at P1(D) and +175V at P1(E). Measure DC voltage at junction of CR8 and CR9 (should be about +65 to 70V). Voltage at CR8 cathode should be about +150V. Refer to Paragraph 5-16 for board removal procedure. When replacing board, be sure clip-on wires are connected correctly.

WARNING

USE EXTREME CAUTION WHEN TROUBLESHOOTING THIS ASSEMBLY AS +175 VOLTS IS PRESENT AT MANY POINTS ON BOARD.

A12 OPERATION

This assembly contains eight neon lamps located on right of display. Lamps are designated Mhz, kHz, ms, μ s, ns, * (asterisk), and GATE. With exception of GATE lamp, all lamps are controlled by TIME BASE/MULTIPLIER switch S4 and Function Selector switch S5. This assembly may be programmed from J8 (REMOTE PROGRAM connector) when Function Selector switch is set to EXT. GATE light is controlled by gate light driver on A8 assembly.

A12 TROUBLESHOOTING

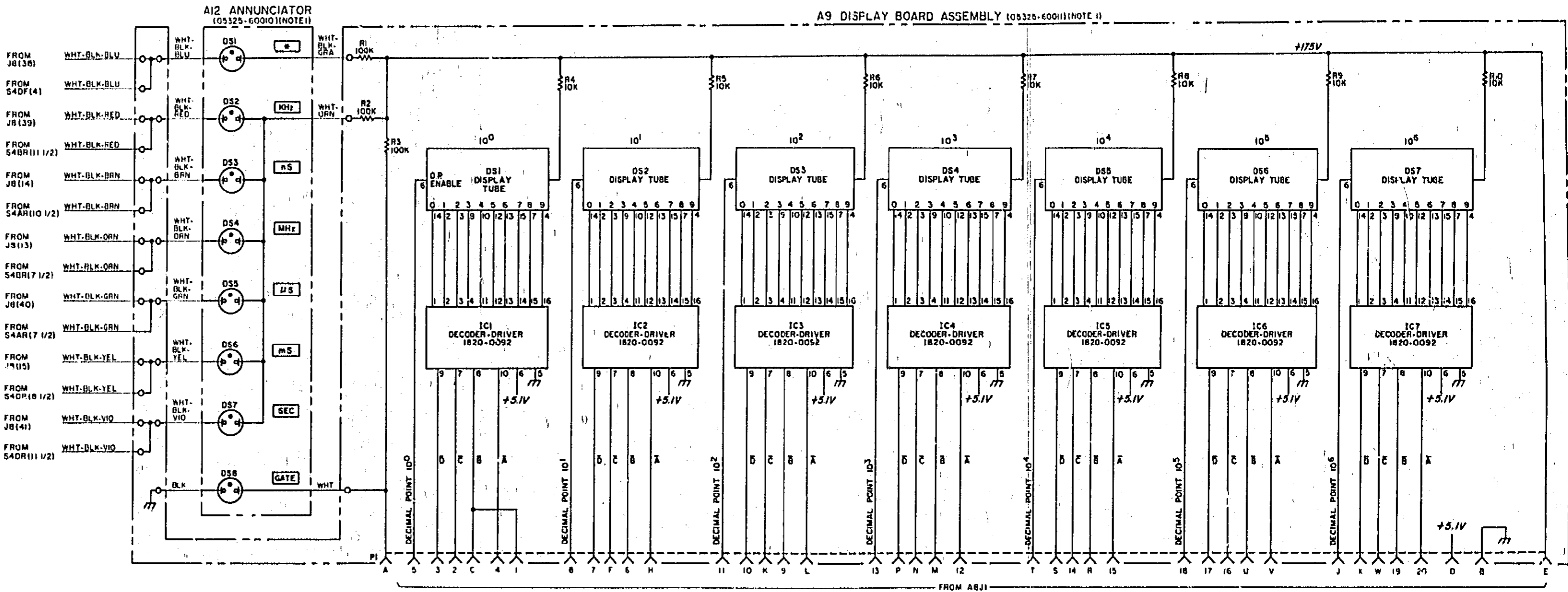
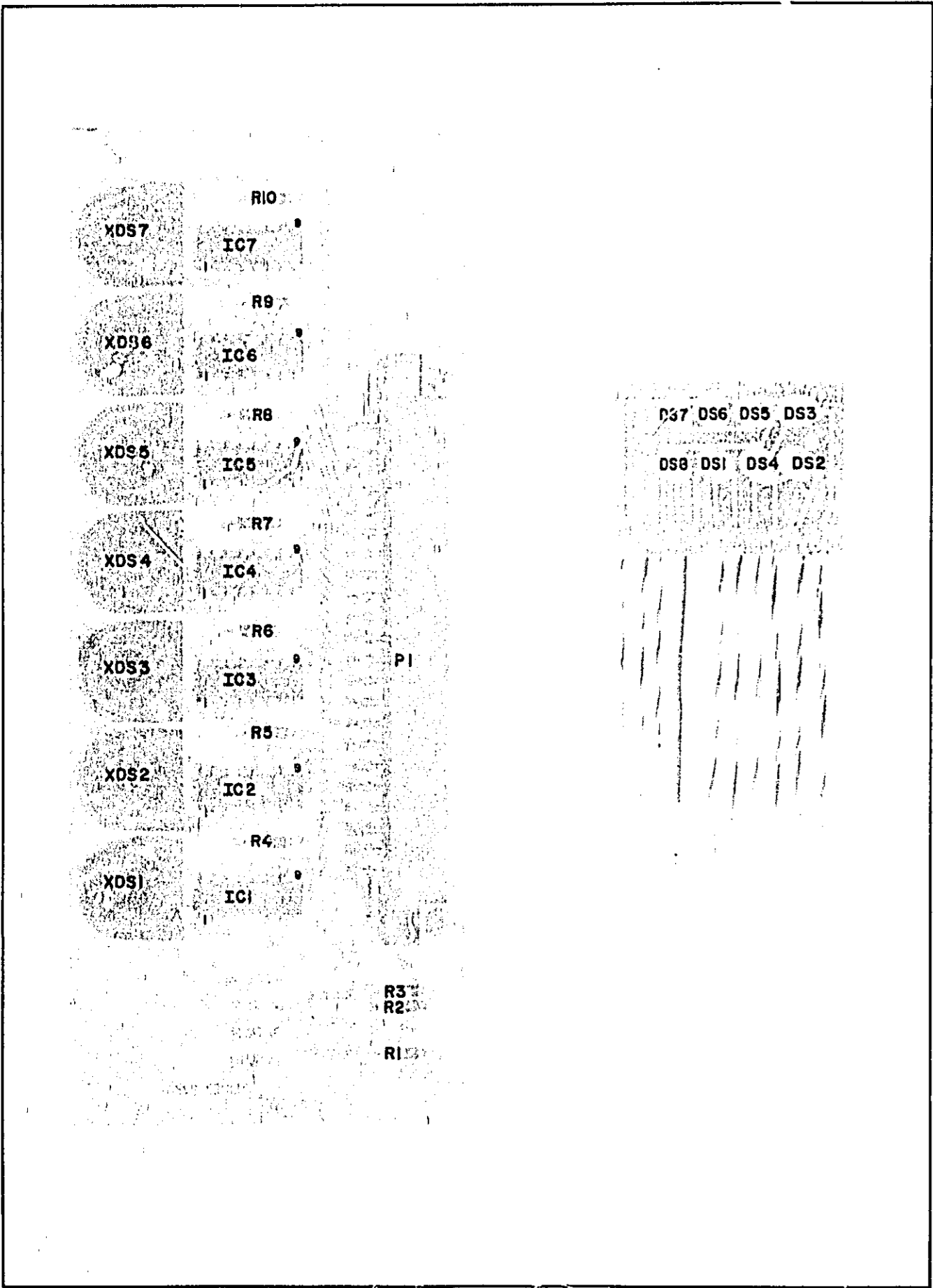
Check DC voltages and see that no wires are broken or disconnected. Refer to Paragraph 5-17 for board removal procedure. When replacing board, be sure clip-on wires are connected correctly.

WARNING

USE EXTREME CAUTION WHEN TROUBLESHOOTING THIS ASSEMBLY AS +175 VOLTS IS PRESENT AT MANY POINTS ON BOARD.

Table 8-4. Decoder Driver

Decoder Driver (H = High, L = Low)															
Digit	Input L = <0.4V, H = >0.4V				10 Line Output H = > 55V, L = < 3V										Number Lighted
	Pin Number				Pin Number										
	9	7	8	10	1	2	3	4	11	12	13	14	15	16	
Blank	L	L	L	L	H	H	H	H	H	H	H	H	H	H	None
0	H	H	H	H	L	H	H	H	H	H	H	H	H	H	0
1	H	H	H	L	H	L	H	H	H	H	H	H	H	H	1
2	H	H	L	H	H	H	L	H	H	H	H	H	H	H	2
3	H	H	L	L	H	H	H	L	H	H	H	H	H	H	3
4	H	L	H	H	H	H	H	H	L	H	H	H	H	H	4
5	H	L	H	L	H	H	H	H	H	L	H	H	H	H	5
6	H	L	L	H	H	H	H	H	H	H	L	H	H	H	6
7	H	L	L	L	H	H	H	H	H	H	H	L	H	H	7
8	L	H	H	H	H	H	H	H	H	H	H	H	L	H	8
9	L	H	H	L	H	H	H	H	H	H	H	H	H	L	9



- NOTES
- REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
 - UNLESS OTHERWISE INDICATED:
RESISTANCE IN OHMS;
CAPACITANCE IN PICOFARADS;

REFERENCE DESIGNATIONS

A9	A12
DS1-7	DS1-8
IC1-7	
PI	
RI-10	

00127-D-22

Figure 8-21. A9 Display Board
A12 Annunciator
8-35

A10 OPERATION

This assembly supplies +12 volts and -12 volts. The two regulator circuits depend on each other for operating bias. The -12V supply also gives bias to +5.1 volt regulator on A11. If the +12V or -12V regulator is overloaded, it will turn off the other regulator. This, in turn, will shut off the regulator being overloaded. To restore power, reset switch S1 must be momentarily closed (push down), or AC line voltage interrupted.

A10 TROUBLESHOOTING

If there is no output, try pushing reset switch S1 on board. If supply does not restart, alternately disconnect leads from XA10 (pins 9, 10 and 1, 2) while trying reset switch again. Make resistance measurements to check diodes and transistors.

CAUTION

DO NOT SHORT METAL PLATES PROTRUDING FROM BOARD. THESE ARE HEAT SINKS FOR A10Q2 AND Q5 AND ARE "HOT" TO THE COLLECTORS OF THESE TRANSISTORS.

A11 OPERATION

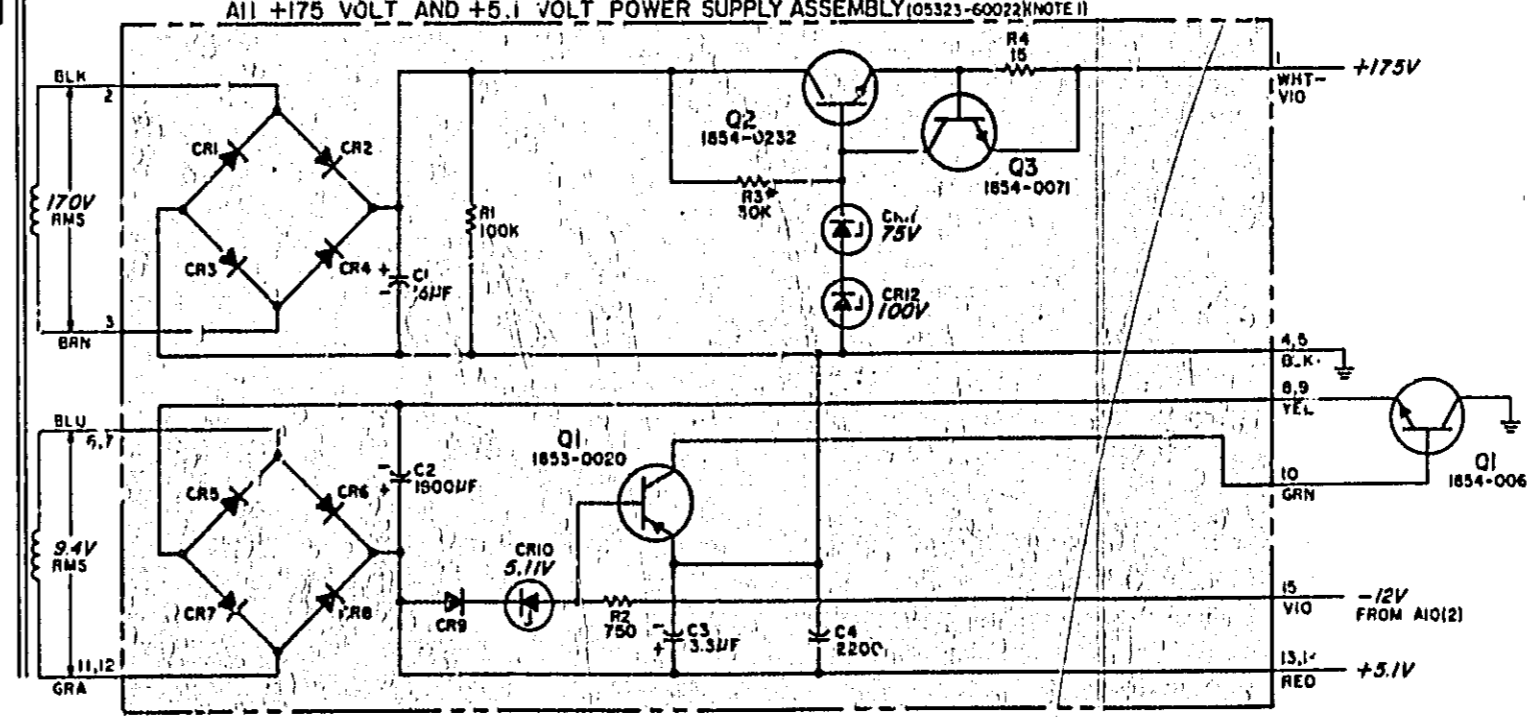
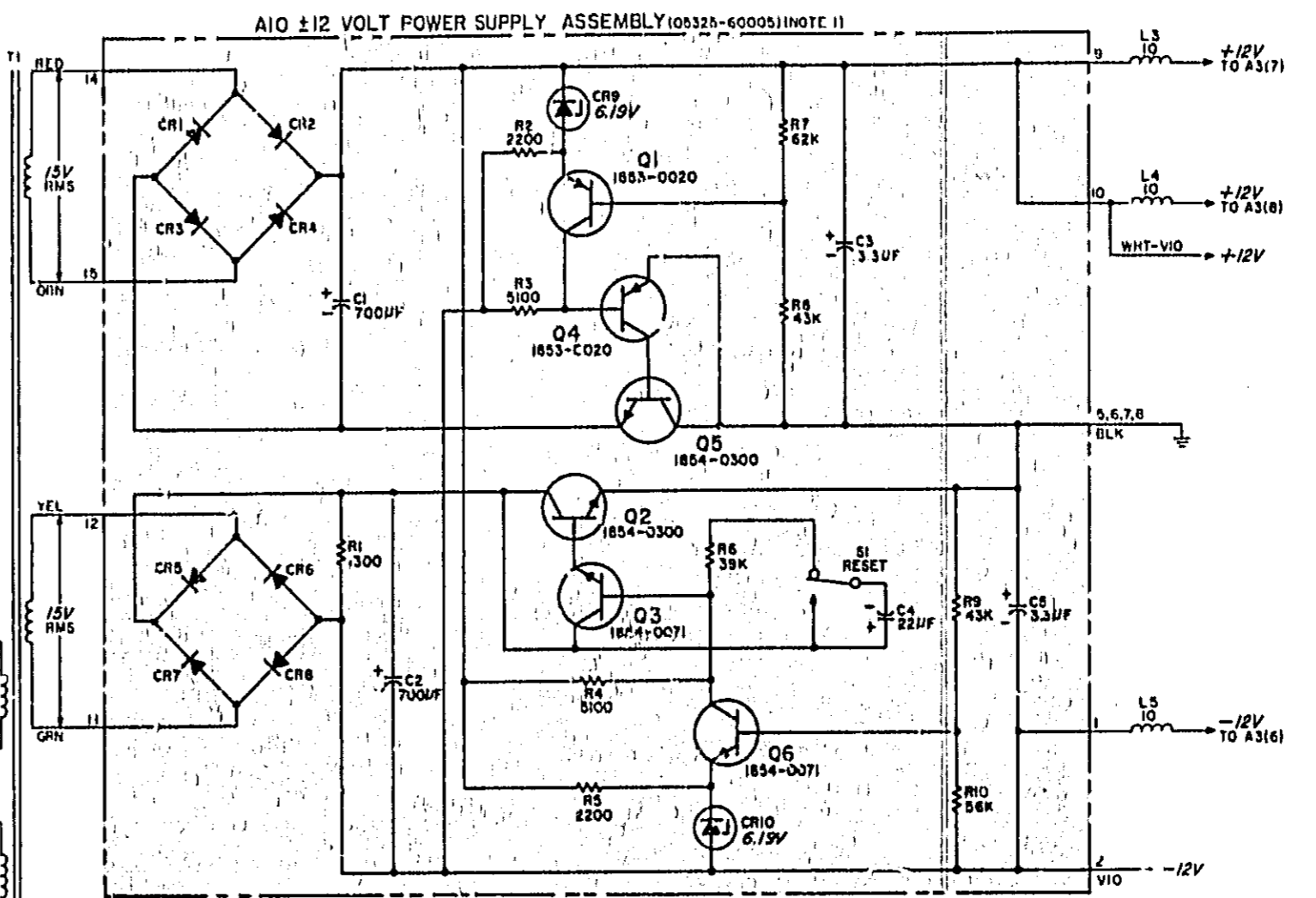
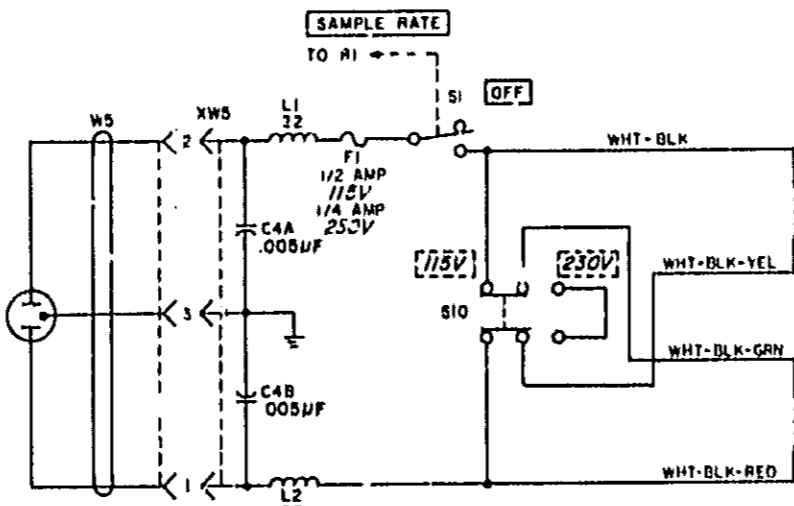
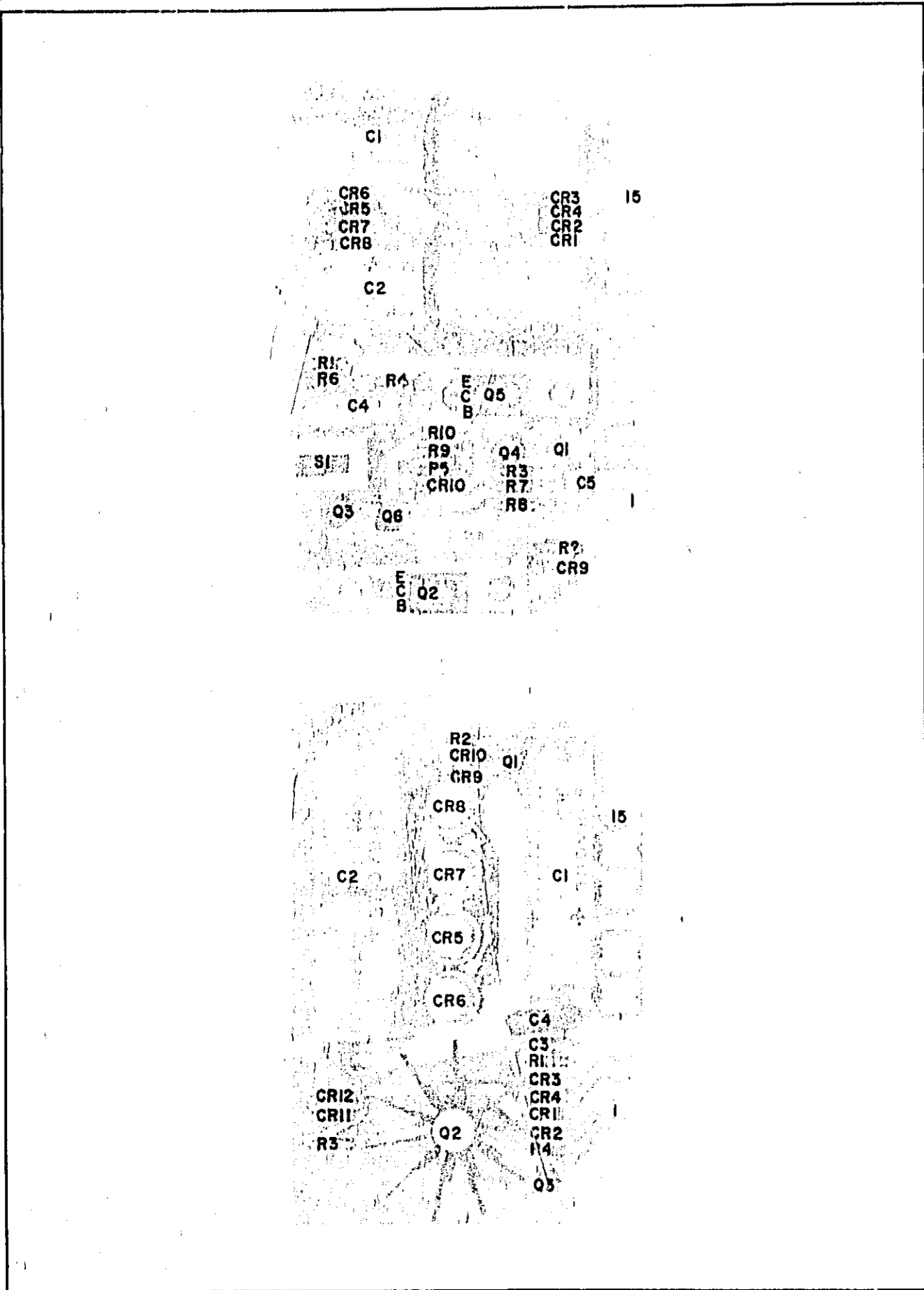
This circuit supplies +175 volts and +5.1 volts. The +175 volts supply operates the digital display tubes and the annunciator lamps. The +5.1 volt supply is used primarily to operate the integrated circuits throughout the instrument. The +5.1 volt supply is a series regulator circuit and receives operating bias from the -12 volt supply on A10.

A11 TROUBLESHOOTING

Make voltage and resistance measurements. If trouble is encountered with +5.1 volt supply, check to see that -12 volt bias is at pin 15.

WARNING

USE EXTREME CAUTION WHEN TROUBLESHOOTING THIS ASSEMBLY AS +175 VOLTS IS PRESENT AT MANY POINTS ON BOARD.



- NOTES
1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
 2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS; CAPACITANCE IN PICCOFARADS; INDUCTANCE IN MICROHENRIES
 3. ASTERISK(*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN
 4. A10Q2,5 AND A10Q2 HAVE HEAT SINKS.

REFERENCE DESIGNATIONS		
NO PREFIX	A10	A11
C4	C1-5 CR1-10	C1-4 CR1-12
F1		
L1-5		
Q1	Q1-6 R1-10 S1	Q1-3 R1-4
S1,10		
T1		
W5		
XW5		

Figure 8-22. A10 ±12V Power Supply
A11 +175 and +5.1V Power Supply
8-37

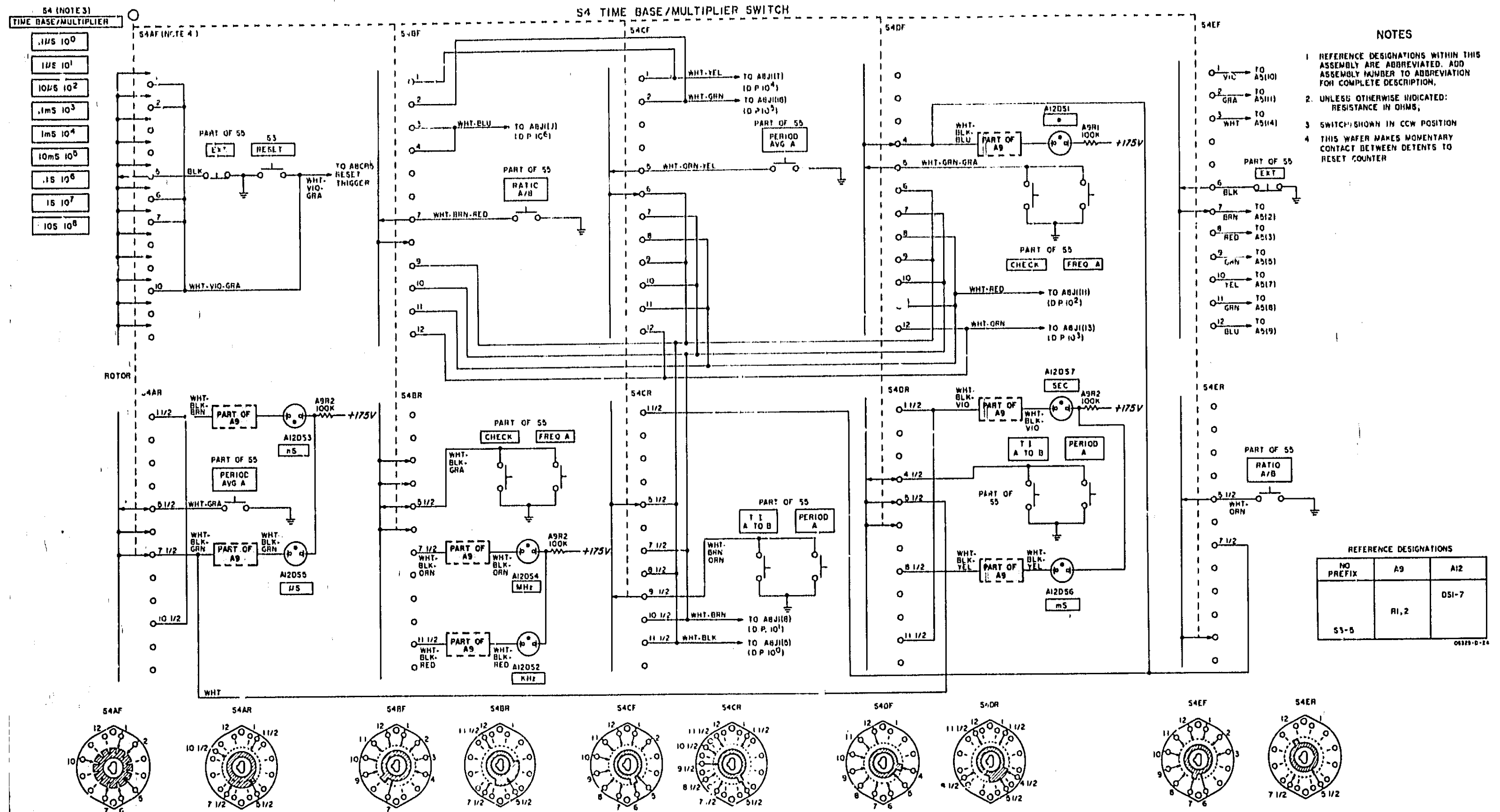


Figure 8-23. S4 Time Base/Multiplier

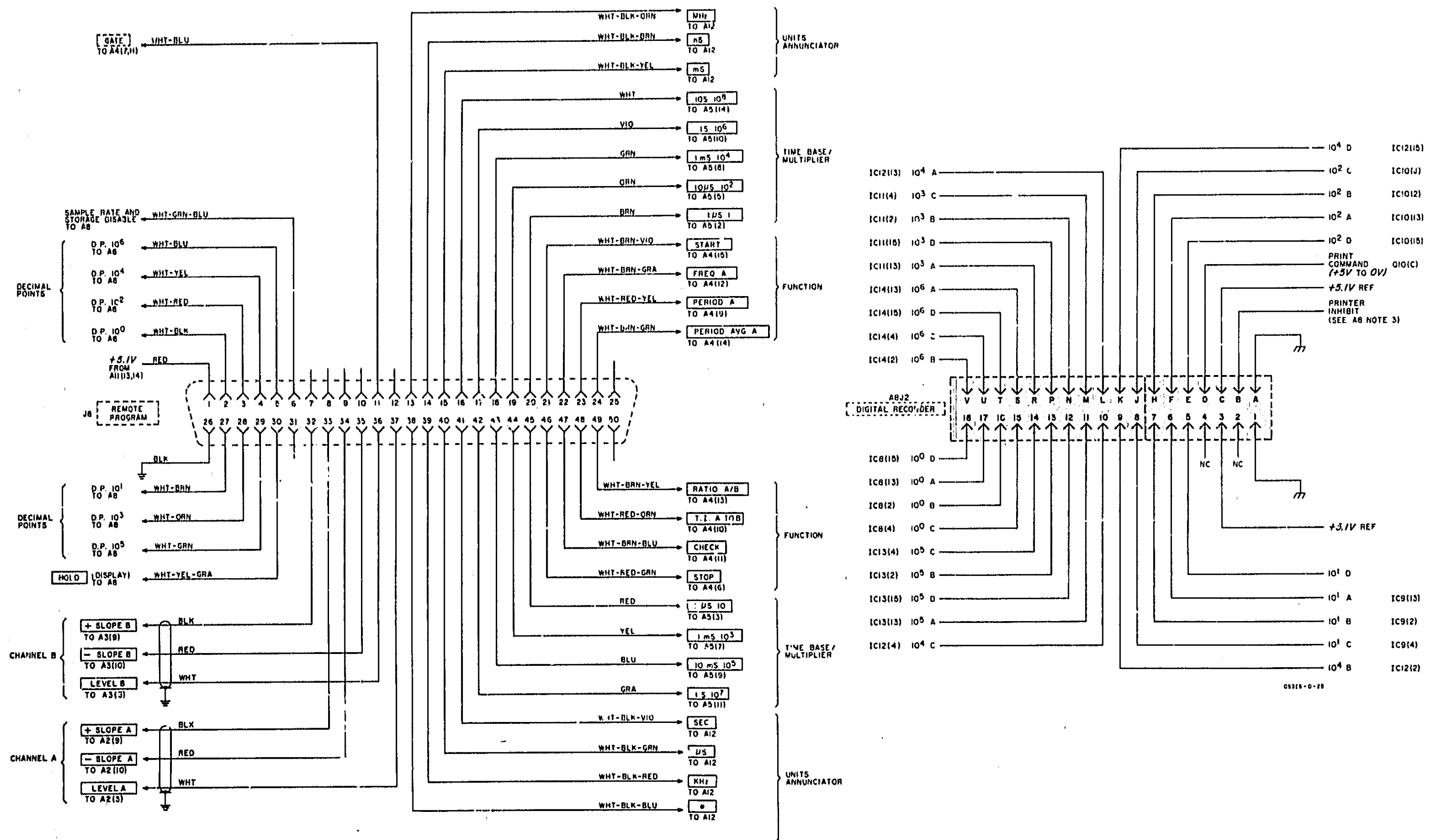


Figure 8-24. A8J2 Digital Output Connector

MANUAL CHANGES

HEWLETT PACKARD MANUAL CHANGES

MANUAL DESCRIPTION	
INSTRUMENT:	5325A/B
SERIAL PREFIX:	1219A
DATE PRINTED:	JULY 1973
HP PART NO:	05325 30013

CHANGE DATE: February 20, 1976

(This change supersedes all earlier dated changes)

- Make all changes listed as ERRATA.
- Check the following table for your instrument's serial prefix or serial number and make listed change(s) to manual.

IF YOUR INSTRUMENT HAS SERIAL PREFIX OR SERIAL NUMBER	MAKE THE FOLLOWING CHANGES TO YOUR MANUAL	IF YOUR INSTRUMENT HAS SERIAL PREFIX OR SERIAL NUMBER	MAKE THE FOLLOWING CHANGES TO YOUR MANUAL

► **NEW OR REVISED ITEM**
ERRATA

Page 7-3, Figure 7-2:

Change K1 to K6; K2 to K6; K3 to K7; K4 to K8; K5 to K1; K6 to K2; K7 to K3; K8 to K4.

► Page 5-7, Table 5-3, RATIO A/B Cont'd:

Delete table and NOTE and replace with following:

TIME BASE/MULTIPLIER	DISPLAY
1	1
10	.5
10 ²	.50
10 ³	.500
10 ⁴	.5000
10 ⁵	.50000
10 ⁶	.500000
10 ⁷	.5000000
10 ⁸	.50000000
OVERFLOW	.0000000